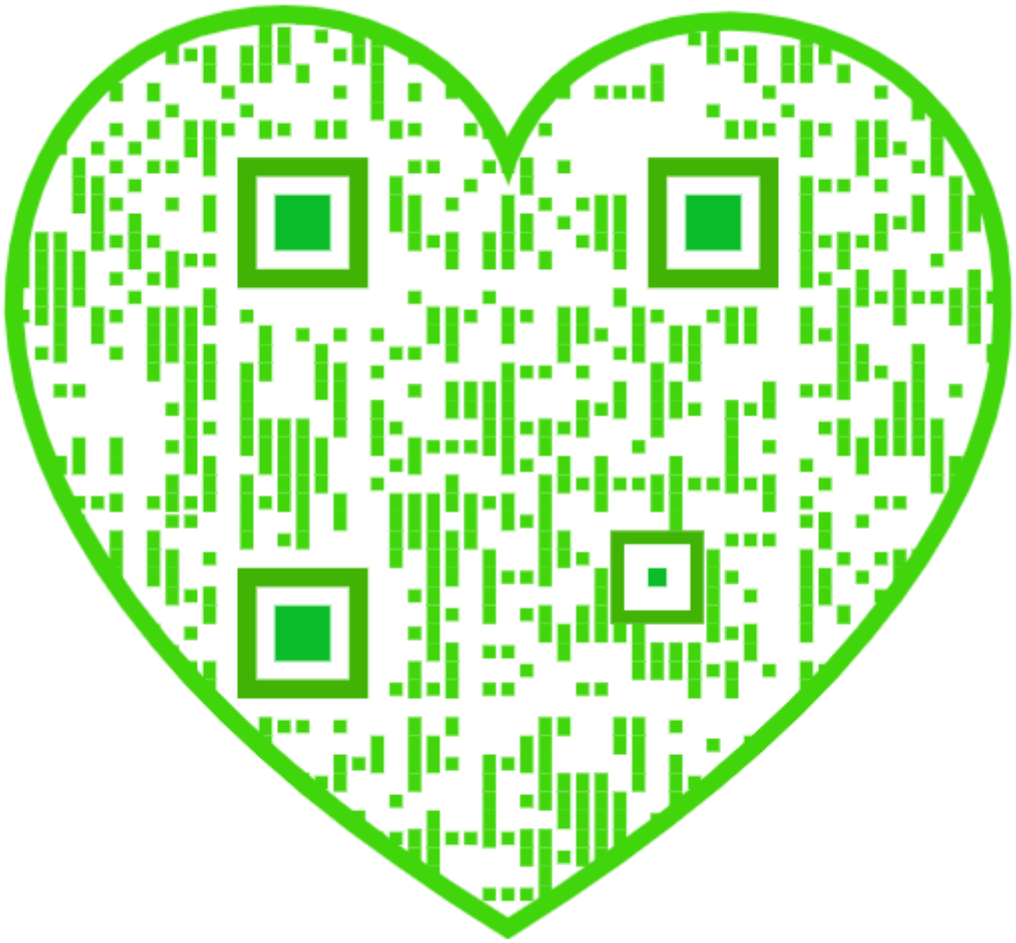

THE

GRAPE CULTURIST:

A TREATISE

ON THE

CULTIVATION OF THE NATIVE GRAPE.

BY

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Practical Horticulturist, Brooklyn, N. Y.

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PREFACE.

THE object in presenting this little treatise upon the cultivation of the native grape is not to promulgate new theories or principles, but to elucidate the practice of those already known. Neither is it offered for the purpose of instructing those who are already familiar with the subject, but only for those who do not know and are seeking knowledge.

For several years past I have been urged to give the results of my experiments in grape culture to the public. I have now partially, at least, complied with the request, stating the difficulties that have been met and how they were overcome—not in finely-drawn sentences, but in the plain and perhaps homely language of a practical horticulturist.

Scientific terms that are not familiar to all have been avoided as far as possible, as it has been my aim to make the subject so plain that none could accuse me of misleading, if I did not properly direct them.

The horizontal arm and renewal system of training has been given, as I believe it to be the best for general vineyard culture as well as for gardens, where circumstances will permit of its being used. It is now twelve years since I trained the first vine with horizontal arms; and though various systems have been tried since that time, none have given me such uniform and satisfactory results as this. It may not be the best system known, but is certainly a good and reliable one.

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At the present time there is much excitement throughout the country with regard to grape culture; old systems are being revived, and new ones invented. The same is true with regard to varieties; many of the old, discarded kinds will be brought forward as new, and when introduced with really good ones, they will be tolerated until their worthlessness is again ascertained.

In the short notice that is given of some of the most prominent varieties in cultivation, as well as some of the different modes of culture, I have endeavored to avoid all extremes; and if in doing so I shall save the reader from some of the bitter disappointments which are more or less the lot of all who undertake the cultivation of fruits, then will my object be fully accomplished.

THE AUTHOR.

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THE

GRAPE CULTURIST.

CHAPTER I.

INTRODUCTORY.

EVERY one who has read ancient history, or studied any of the numerous works on vine culture, is aware that the grape has been cultivated and esteemed as one of the choicest fruits ever since the earliest period. Vine culture has been a constant attendant upon civilization, following it from country to country, and progressing with it; yet the same species of vine that thrives so well over a great portion of the Eastern Hemisphere has, except in a few isolated locations, entirely failed in this our favored land. Although we may regret that the European grape is unsuited to our climate, yet we may congratulate ourselves that we have indigenous species from which new varieties have been produced which rival, in point of flavor at least, any of the foreign ones; and we are encouraged to hope for a native grape which shall equal the European in every good quality.

The culture of the vine in this country has had many obstacles to contend with. Those who had been accustomed to the fine grapes of Europe could see nothing in the inferior native grapes of this country to induce them to attempt to cultivate them. For many years the vineyards in this country were planted with foreign varieties

which, of course, failed, and the vineyardist,* thinking that there was nothing among our indigenous vines worthy of his attention, replaced them with new importations from Europe, and found his trouble again rewarded by failure. After two centuries of unsuccessful attempts to grow the European grape in open culture in this country, pomologists turned their attention to the improvement of our native species of vine, and their experiments have given us many choice and beautiful varieties. It is only since foreign varieties have been discarded for our hitherto neglected native sorts, that vine culture has become established as a branch of American industry.

BOTANICAL CHARACTER OF THE VINE.

Botanists have differed as to the number of species of vine belonging to this country, and this can not be wondered at in a plant which is so disposed to run into varieties. Professor Asa Gray, the high authority of whose works will be conceded, makes a much less number of species than many other botanists, and I have followed him in the classification on next page. I must remark, however, that there are several native varieties which are found in certain sections of the country, which are very puzzling, and one is at loss as to which of the admitted species they should be referred. These varieties, though growing indiscriminately with others about which there is no doubt, seem to preserve their identity, and it is very difficult to decide whether to call them distinct species or marked varieties of the species enumerated by Gray. Practically

* Although this word has not yet found its way into the dictionaries, it appears to be just as applicable to the cultivation of the vine as orchardist, pomologist, etc., are in other departments of fruit culture. It has been employed by several writers of late, and was used so long ago as 1853 by Dr. Togno in a letter to Charles L. Fleischman. See *American Polytechnic Journal*, page 317.

it is of little consequence what view is taken of these unusual forms, as the cultivator is interested in them only as varieties, and it is of no particular moment to him whether we have one hundred or only one native species, so long as there are a sufficient number of varieties to suit all soils and locations.

VITIS. (GRAPE.)

Calyx very short, usually with a nearly entire border or none at all, filled with a fleshy disk which bears the petals and stamens: petals 5, cohering at the top (Fig. 1, A), while they separate at the base, the corolla usually falling off without expanding: 5 thick glands or lobes of the disk alternating with the stamens, between them and the base of the ovary: flowers in a compound thyrsus, diœcious-polygamous in all the American species, exhaling a fragrance like that of Mignonette; leaves simple, rounded, and heart-shaped, often variously and variably lobed.

Fig. 1.

Vitis Labrusca.—(Northern Fox Grape.) Branchlets and young leaves very woolly; leaves continuing rusty-woolly beneath; fertile panicles compact, berries large ($\frac{1}{2}$ to $\frac{3}{4}$ of an inch in diameter). Grows in moist thickets, common. Flowers in June. Berries ripe in September. Dark purple or amber color, with a tough, musky pulp.

Vitis æstivalis.—(Summer Grape.) Young leaves, downy, with loose, cobwebby hairs beneath; smoothish when old, green above; fertile panicles compound, long and slender; berries small ($\frac{1}{3}$ to $\frac{1}{4}$ inch in diameter), black, with a bloom. Thickets, common; climbing high. Flowers in May and June. Berries pleasant; ripe in October.

Vitis cordifolia.—(Winter or Frost Grape.) Leaves thin, not shining, heart-shaped, acuminate, sharply and coarsely toothed, often obscurely 3-lobed; panicles com-

pound, large and loose; berries small (¼ inch broad), blue or black, with a bloom, very acerb, ripening after frost. Variety, RIPARIA; with the leaves broader and somewhat incisely toothed and cut-lobed. Thickets and river-banks, common. May and June. Flowers very sweet-scented.

Vitis vulpina.—(MUSCADINE OR SOUTHERN FOX GRAPE.) Leaves shining on both sides, small, rounded with a heart-shaped base, very coarsely toothed with broad and bluntish teeth, seldom lobed; panicles small, densely flowered; berries large (½ to ¾ inch in diameter), musky, purplish without a bloom, ripe early in autumn. Rivers, Maryland to Kentucky and southward. May. Branchlets minutely warty. Fruit with a thick and tough skin. A variety yields the Scuppernong Grape.

The two thousand varieties of the grape that are now or have been under cultivation in Europe, are supposed to have originated from one species—namely, the *Vitis vinifera*, and it is not positively known which one of these two thousand varieties is the original, although it can be proved that many of them are not: it is therefore impossible to give a description of the foreign vine so that it can be recognized by one not previously acquainted with the general appearance of the many varieties belonging to it. Language, however skillfully applied, is often inadequate to describe to others our own knowledge or impressions. For instance, we may have a friend whom we wish to describe to another so that he shall be able to know him among a thousand; but unless the one described has some unusual mark to designate him, twenty may be found in the thousand to answer the description exactly—at least to a stranger. So it is with the foreign vine; to those who have become acquainted with both it and the native species, it is an easy task to distinguish one from the other, no matter how much each may vary; but to describe the two so that others may learn the difference is not so readily

done. Foreign varieties have leaves ranging through all the gradations of color known as green—so have ours; some approach the red—so do ours; many have a very shining surface, and others are downy or woolly—so are ours. The leaf of the European grape also presents every conceivable shape, preserving, however, characteristics enough to be recognizable as belonging to the grape genus. And we have one species, the *Labrusca*, the varieties of which will match any of them in shape. The young wood of many of the foreign varieties is covered with a grayish-blue bloom, said by chemists to be wax: this is sometimes considered a distinctive mark of the foreign varieties, but our *cordifolia* is abundantly furnished with it. We could multiply these parallel characters indefinitely, but enough has been said to show how difficult it is to designate the species to which a particular variety belongs, especially if we have words only for our guidance. There are, however, certain characteristics so prominent that they may serve as a partial guide until some freak of nature admonishes us to lay them aside. 1st. The skin of our native grape slips from the pulp, while that of the foreign varieties adheres to it like the skin of the apple, and those which have a fleshy pulp allow the seeds to drop from it when it is broken. The seeds of our native grapes are enveloped and held together by the pulp, more or less persistent in different varieties; but to observe this the fruit of some of the newer ones must be examined before they are fully ripe, for at that time the pulp has become so tender that it is scarcely more than a liquid. The tough pulp is a prominent characteristic of the *Vitis Labrusca* and its varieties. 2d. The bark of the native grapes, particularly on the one-year-old canes, parts very readily from the wood; it is also quite tough, and in some instances it may be divided into small threads resembling hemp, while the bark on the young wood of the foreign vine usually adheres more firmly, and is also quite

brittle. The bark of the native vines, particularly the northern species, is harder than that of the foreign one, and the prevailing colors are dark maroon or brown, varying to light orange. Very few of the cultivated native varieties have any bloom upon the young wood, while that of the foreign ones, when grown in the open air, usually has a grayish or ashen hue, and is also more or less supplied with a peculiar blue bloom.

Many other peculiarities might be noticed, but as we do not recommend foreign varieties for out-door culture in the Northern States, there is no necessity of pursuing this subject further.

PROPAGATION BY SEED.

As the propagation of the grape from seeds is the only method by which new varieties can be produced, it is all important to the welfare and prosperity of grape culture in this country that it should receive the attention of all friends of progress in this department of horticulture. Although great advance has been made in the last few years, and we now have a few fine table and wine grapes, yet we have none that are perfect, or but what may be far surpassed, even if only ordinary skill is applied to the growing of seedlings.

The seeds should always be gathered from grapes that are fully ripe, and from the best varieties that can be obtained. Those varieties which have any prominent defect, such as slow growth, thin small leaves, those that are liable to mildew, vines that are tender, or ripen their fruit very late, should be avoided, unless they possess some excellent quality which it would be desirable to perpetuate, and which can not be found in any other variety. It must not be expected that good, strong, healthy seedlings will be grown every year, even from the very healthiest native variety, as the seeds of the grape are not fully developed

every season, although the grape itself may appear to be perfect. I mention this, that those who fail to grow good healthy seedlings on the first trial may not be discouraged. The next season, with no greater care, they may have perfect success. It must not be expected that all the seedlings, nor any great portion of them, will produce better fruit than the parent, for although the vine has a tendency to improve upon its *wild* nature—a return, as it were, for the care and labor bestowed upon it—yet after it has taken a few steps toward civilization, a large portion of its offspring show a disposition to recede to their original state. In growing a thousand seedlings from a choice improved variety, if we succeed in getting one even but little better than the parent, we would be well repaid.

It is this very uncertainty that affords the pleasure and the rarity of satisfactory results which gives value to this department of grape culture. Seedling grapes are from three to ten years in coming into bearing—usually the wildest and the most inferior varieties will grow the strongest, and come into bearing first. In 1862 I marked several two-year-old seedlings that showed strong indications of their wild character, for the purpose of ascertaining how near one could judge of the worthlessness of a seedling by its leaf and growth. This season several of those marked produced fruit, being only three years old, and every one of them was as worthless in fruit as they were wild in growth, although they were all from improved varieties.

Occasionally a seedling will be grown that will never produce fruit; for (see botanical description) our native varieties are sometimes dicœcious, that is, one vine produces flowers having only pistils, and another only stamens. Fig. 2 shows a grape flower (somewhat magnified) after the petals have fallen. The pistil, C, is in the center, while the five stamens, B,

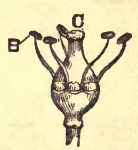

Fig. 2.

surround it. If it should happen to be the former (pistillate), then the flowers may be fertilized from the perfect flowers of another vine; but should it prove to be one of the latter, with staminate or male flowers, then it will produce no fruit. Although we speak of flowers being staminate, yet we have never seen, nor have we good authority for believing, that there are any varieties or species that are entirely wanting in the rudiments of a pistil, though it may be so deformed that its usefulness is destroyed.

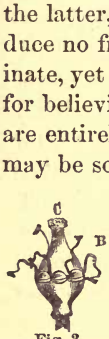

Fig. 3.

Again, there will occasionally appear seedlings with both perfect and imperfect flowers on the same vine and in the same cluster; such vines are called polygamous. These occur more frequently than the dicecious; and if imperfect flowers occur, then of course we have very imperfect bunches of fruit, although this may not always be owing to a deformed stigma, but to an insufficient supply of pollen, owing to deformed stamens. The Taylor grape (white) and Oporto (black) are striking illustrations of perfect and imperfect flowers in the same cluster. But the imperfections in the flowers of these seem to be mostly in the stamens, they being very much deformed; for when the cap or petals drop off, the stamens are bent down, as seen, B, in Fig. 3; not standing erect as shown in Fig. 2.

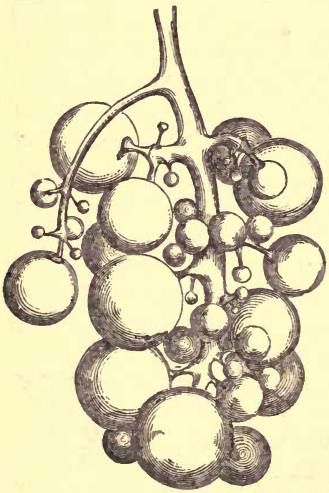
Fig. 4.

Fig. 4 represents a fair sample of the bunches produced upon a vigorous six-year-old vine of the Taylor.

Some of the bunches contained more perfect berries than the one from which this engraving was made, and others with not more than two or three perfect ones. The small undeveloped berries are those that were not fertilized. Other varieties of this class show the same phenomenon, and all that I have examined exhibit more or less the deformed stamens as shown in Fig. 3. The Taylor and Oporto are both pure native varieties and nearly related, and belong to what appears to be a distinct species, found growing along the Alleghany range, from southern New York to Alabama, and along the banks of those streams that flow from these mountains. It probably is also found near the Rocky Mountains, as several varieties lately received from Nebraska and Kansas appear to belong to the same species.

Some of the individuals of this group possess excellent qualities, which, when properly developed, and their defects remedied, will make the most valuable wine grapes of the country.

CHAPTER II.

GROWING FROM SEED.

Gather the grapes when fully ripe, and either dry them in the sun or in a dry room, until they appear like raisins, and keep them in this way until spring, or, when they are gathered, the seeds may be separated from the pulp. Put in pots or boxes of pure sand or sandy loam, and set away in the cellar or bury in the open ground until spring. Mice are very fond of grapes and grape seeds, and they should be placed where these pests can not reach them. No matter whether the seeds are frozen or not, all that is requisite is, that they shall not get too dry; if they are kept cool and moist, their germinating powers will remain unimpaired.

The soil for a seed bed should be light, moderately dry, and thoroughly pulverized to at least two feet in depth. If not naturally very rich, it should be made so by adding a liberal quantity of old well-decomposed manure from the barnyard, and incorporating it well with the soil. The whole success often depends upon getting a good, strong, healthy growth the first season. So soon in the spring as the weather will permit, sow the seeds in drills about a foot apart, and not too thickly in the drills—one or two inches apart will do; cover about three quarters of an inch deep, and give a liberal supply of water, if the weather is dry. When the plants first appear above ground, they should be *partially* shaded, to prevent their being burnt off by the sun. The shading may be dispensed with so soon as the second or third leaves are formed, at which time small sticks, say from a quarter to one half inch in

diameter and two feet long, should be stuck by the side of each plant; every little plant will throw out its tendrils and attach itself to the sticks, and grow much more rapidly than it would if such a support were not given. The stakes, if set thickly together, will afford a partial shade to the young plants, which is often very beneficial, especially if the summer should prove very warm. Another method with which I have succeeded most admirably, is to sow the grape seeds thinly in the drills with apple seeds; the apple seedlings coming up with those of the grape, or usually a little before, they afford just sufficient shade for the young vines; and as the vine grows, they fasten themselves to the young trees, which serve in place of stakes. A still better plan would be to sow the apple seeds in drills, running east and west, one foot apart, and the seeds about one inch apart in the drill, after which sow the grape seeds on the north side of the drill, but close up to them, say within two inches at least. I use apple or pear seeds instead of cherry, peach, or similar kinds, because they produce but very few side roots the first year, and consequently do not interfere with the growth of the seedling vines. When the plants have made a few inches of growth, a light mulch of leaves, hay, or moss may be spread over the entire surface of the bed; this will keep the roots moist and prevent any sudden check to their growth. If the weather should prove dry, give an occasional watering—not a sprinkling, but a good soaking; once a week will be sufficient. No liquid manure will be needed if the soil was properly enriched when the bed was made; but if the vines do not grow as rapidly as desired, then put a few shovelfuls of good fresh barnyard manure into a barrel of water, stir it well, let it settle, and then draw off the water and apply it to the plants; or, instead, a solution of two pounds of guano to a barrel of water may be used with good effect. If there should be signs of mildew on the plants, a few handfuls of sulphur, scattered over the

plants and bed will usually prevent its farther progress. Grape seedlings when well started, usually grow quite rapidly, often making two to four feet of wood the first season.

Those who have green-houses or hot-beds may sow the seeds in boxes or seed-pans, and place them in these structures, so that they may receive artificial heat; but for growing hardy varieties the open ground is preferable, as it is more natural; and the sickly seedlings, of which there are always more or less, will be more likely to show their feebleness in the open ground, and can be selected from the vigorous and thrown away, avoiding further trouble. When the plants have made one season's growth, and the frost has killed their leaves, they should be taken up, a portion of the stem cut off, and the long perpendicular root shortened at least one half its length; then heel them in, in some dry warm place in the open ground. All small sickly-looking plants should be thrown away, for they will seldom make good vines if they fail to make a good growth the first season. At the approach of very cold weather, cover the entire tops with soil or coarse litter, deep enough to insure them against being severely frozen, not that freezing would be sure to kill them, but it would tend to impair their vitality. In the spring take out the plants and cut the stems off to within four inches of their roots, then plant them out in rows four feet apart, and three or four feet apart in the rows. The ground for their reception should be made rich and deep, using any old well-decomposed manure that may be at hand, or old sods, or muck; if the latter is used, a peck of ashes to the square rod, or half that quantity of lime, may be added with good effect. The whole soil should be worked over at least eighteen inches deep, either with the plow or spade.

The roots of the vines should be carefully spread out, so that no two will come in contact; then sprinkle the soil

among them, covering so that the upper bud on the four-inch stem will be just above ground; this will give about three inches of soil above the upper tier of roots, which is sufficient for young plants, and more than this would be injurious. After the vine is planted, press the soil down with the foot, so that it shall be firm, but not packed. A good strong stake, say one and a half inches in diameter and six to eight feet long, should now be put down by each plant to tie it to as it grows. Let but one shoot grow, and pinch off all side branches as they appear; keep the vine tied to the stake so that it shall not get broken off by the wind and thereby checked in growth. Keep the ground clear of weeds, and stir the surface often with the hoe or rake, but never deep enough to reach the roots. On very loose and porous soils it is better to mulch the plants; but if the soil is a compact loam, or somewhat clayey, then it is better to hoe often than to mulch, because if you cover up soils that are naturally compact, they will hold too much moisture, and sometimes become soured for want of aeration.

At the end of the season's growth, and just before the ground freezes, the vines should be pruned, by cutting them back to within eight or ten inches of the ground; then bank up the soil about them, or bend them down and then cover them; if covered with straw or leaves, there is danger of their being destroyed by mice. All that is now required is to protect them slightly from the sudden changes in winter. The following spring remove the covering and give the vines a top-dressing of manure, and work it in with the hoe during the summer. The vine should be allowed to make only a single shoot this (the third) season, and if healthy and vigorous it will make a growth of ten to fifteen feet if not checked; but if allowed to grow unchecked, it would necessitate very long and stout stakes, besides the trouble of keeping them tied. It is best not to allow them to grow so long, but pinch off the tops when

they have grown five or six feet high, and when they start again and have grown a foot or more, check them again; also pinch off the ends of all the side shoots, or laterals, as they are termed; this concentrates the strength of the vine and hastens its maturity.

The vines are now three years old, and we may begin to look for fruit next season, if they have not already shown it upon some of the strongest. But to be sure of getting a strong growth next season, we should prune the vines back to two feet, and allow but two shoots to grow; and further, they are more likely to produce fruit from the lower than the upper buds, particularly if cut back.

This cutting back may be deferred until the last of February, unless it is desirable to cover the vines again, which it is not, unless the climate is so severe that it is not expected they will ever withstand the winter. In the vicinity of New York I would not cover seedlings after the second season.

We have now followed our grape seedlings until they are four years old; they should now be kept pruned pretty short, say to two or three buds of the previous season's growth, every season until they have fruited, and then select those that promise well and discard the others. If cuttings or layers are taken from the seedlings, they will often produce fruit before the parent plant. For the manner of making these, see chapter on propagating by layers and cuttings.

CHAPTER III.

PROPAGATION BY SINGLE BUDS.

The mode of propagating of the grape from single buds or eyes is particularly valuable when it is desired to increase rare and desirable varieties. It is supposed to have been first suggested by the Rev. Mr. Mitchell, of England, in 1777, and has been practiced sufficiently to establish its true merits—some of which are: 1st. A greater number of plants can be produced from a given quantity of wood than by any other mode. 2d. Vines so propagated contain just enough of the parent vine to insure the perpetuation of a healthy plant of its kind, but not enough to transmit disease to it by its decay, as sometimes occurs when a large amount of the old wood is used. 3d. As in this mode of propagation so small an amount of wood is used that it admits of a large number of cuttings being started in a small space, and as the buds are always forced into growth by artificial heat, we may commence much earlier in the season than when propagating in the open air, thereby giving a much longer time for increasing, prolonging, and ripening their growth. This is secured even if they are planted out in the open ground so soon as the plants become well rooted and the weather sufficiently warm. 4th. But the greatest benefit arising from this mode of propagating is, that varieties that are very difficult to increase by other methods can be multiplied with the greatest facility by this. In fact, no variety or species has yet been discovered that can not be grown readily with artificial heat from single bud cuttings.

Vines properly grown from single buds are certainly

equal to those propagated by any other mode; but if improperly grown, they are of but little value and often entirely worthless.

The buds used for propagating should be large and well developed, and at no time of their growth should the plants be allowed to receive a check, either by being too cold or too hot. While it may be necessary to keep up a vigorous growth, it must be borne in mind that the plants may be forced too rapidly by the use of stimulating manures and by subjecting them to too great heat, the result of which will be soft, spongy, unripened wood and roots. Sometimes the roots will have small tuberous appendages at their ends, which is often caused by the presence of too much stimulating food. When vines are propagated from single buds, and are kept in pots during the entire season, the enlargement of the ends of the roots will usually occur upon all those that grow out until they reach the sides of the pots. This does not show disease nor overgrowth, but merely that the roots are crowded, and that they need more room. But when these little tubers are found on the small roots all through the soil, it shows that they have been made unhealthy by injudicious treatment. The same phenomenon of dropsical roots is often seen upon vines grown in the open air, especially where large quantities of muck and fresh manures are used without first being thoroughly decomposed.

MODE OF OPERATION.

Cut the wood from the vines in the fall, after the leaves have fallen, but before it has been severely frozen, and put away in moist earth or sand in the cellar or bury it in the open ground, where it will be protected from the frost and can be reached when wanted. The last of February or the first of March is the usual time in this latitude to commence starting the buds. There is nothing gained by

forcing the buds into growth too early; better wait until the season arrives when they naturally begin to swell, as they will then grow more readily and make more healthy plants than if started in the early part of winter. At this time take out the cuttings and cut them up into pieces as represented in Fig. 5; put these into water as they are cut; this will prevent their becoming dry while they are being prepared; and if they are allowed to remain in the water for twenty-four to forty-eight hours, it will do them no harm, but often be of benefit, especially to the hard-wooded varieties, as it softens the alburnous matter from which the roots grow, and loosens the outer bark, and thereby allows the roots to push through it more readily, there being always more roots produced from other parts of the cutting than from that part where the cambium has been exposed by the knife. It is also a benefit to some varieties that produce roots very tardily, to scrape off a portion of the outer bark and the remains of the old leaf-stalk which immediately surround the base of the bud, so as to partially expose the inner bark.

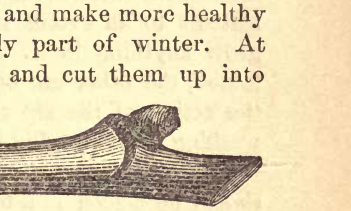

Fig. 5.

When a quantity of the buds are prepared they should be put into moderate-sized pots (six or eight inch is a convenient size) filled to within about an inch of the top with pure and moderately coarse sand, firmly packed. Place the cuttings, with the buds up, about an inch apart all over the surface; press them down firmly with the thumb and finger; sift on sufficient sand to cover the upper point of the bud about a quarter of an inch deep, then press it all down evenly, using the bottom of another pot for the purpose, after which apply water enough to just moisten the whole contents of the pot.

Sand taken from the banks of fresh-water ponds or running streams is the best for propagating purposes, as it is

nearly free from impurities. That taken from common sand banks often contains oxide of iron and other foreign matters to an extent that renders useless all attempts to grow anything in it. When pure sand can not be obtained, the other can be made to answer by exposing it to the action of the air and rains for a few months, or by washing it thoroughly before using.

After the pots have been filled with cuttings, they should be placed in a temperature between 40° and 50°, and allowed to remain from two to three weeks, watering just enough to keep them moist, but not wet. As roots are formed at a much lower degree of temperature, and less rapidly than leaves, we are thus enabled to cause the process of rooting to begin (which is very essential) before we place them in a position to commence growth; and when this does start, the roots, being formed or in process of formation, will then issue with such rapidity that they will be capable of absorbing food to supply the new growth as soon as it has consumed that food which was laid up in the bud the previous season.

After removing the pots from their first position, place them in the frames, which should be partially filled with sand and located over the flues or hot-water pipes, plunging them at least one half their depth in the sand; give them bottom heat of 60° for the first few days, then gradually raise it to 80°; keep the frames partly open, and the temperature of the atmosphere in them ten degrees lower, if possible, than that of the sand under them, bearing in mind that we wish to excite the roots to grow before the leaves. When the buds begin to push, allow the temperature to increase to 90° or 95°, close the frames and keep the atmosphere moist by frequent waterings; a liberal application once a day will usually be sufficient. Pure rain water is best, and should always be of the temperature of the air in the house, or nearly so. Cold water would surely check the growth of the plants. Examine the young

growth every day to see that it does not commence rotting or damping off, as it is called; should there be signs of this, give a little more air; but be careful of cold currents from the outside, as these are often fatal to the young plants. Also avoid the direct rays of the sun, either by whitewashing the glass, or nailing up strips of white muslin or paper to the rafters of the house.

When the plants have made a growth of two or three inches, they should be shifted into two-and-one-half to three-inch pots, putting one plant into each.

Up to this time no material has been used which contained any appreciable amount of plant food, nor has it been needed, for the growth of roots and leaves has been produced from the food stored in the bud and the wood attached, and what little they may have obtained from the water and sand. The plants are now in condition to use more substantial food, consequently the soil in which they are to be potted may be composed of rotted sods, taken from an old pasture, mixed with one half its bulk of old, well-decomposed barnyard manure, or instead of sods use muck, or leaf mold from the woods. These should be mixed together at least six months before using; add one eighth to one quarter sand, and turn all over until it is thoroughly incorporated, then sift it all through a coarse sieve before using. Having put a quantity of the soil upon the potting bench, which should be in the propagating house, and provided a quantity of broken pots or bricks for drainage, take the pots containing the plants from the frames, lay them on their side and give them a sudden jar with the hand, so as to loosen the sand around them, then draw out a plant carefully and hold it in one hand while with the other you place a small piece of the drainage material into the small pot, cover it with soil, then put in the plant, allowing the roots to spread out naturally; fill in soil around them until the pots are full, without covering the roots where they join the stem more than half an inch

deep; press the soil down firmly, but not so hard as to break the roots. When the plants are potted, place them again in the frames, give them water to settle the soil about their roots, and keep the air somewhat confined for a few days until they have become well established in the soil, when a little more air may be given them. Keep the temperature at 85° to 95° during the day and 70° to 80° at night. When the plants have made four to six inches of stem, they may be taken out of the frames and placed in another house which, if they are to remain under glass during the season, should have been made ready for their reception.

Some propagators do not use frames within the house at all, but depend entirely upon keeping the air moist and hot as well as sufficiently confined by the ordinary methods of heating and ventilating the house. While an experienced propagator will usually succeed in this way, for those who have not had experience in propagating, the frames are much safer, and are enough better to pay the extra cost even for the use of the most skillful.

When the plants are first potted in the small pots they will require so much more room than before, that it will often be found inconvenient to furnish frames enough to hold them; in such cases they may be set upon shelves in the open house, and they will do well in such a position if care is given in keeping the atmosphere within the house moist and warm, as well as in shading the plants and avoiding direct currents of cold air from the outside through doors or when ventilating the house.

To get good, large, and strong plants, they will require re-potting at least three times during the summer. At each change the pots used should be increased in size about two inches. The same compost may be used for each re-potting, and the ball of earth around the roots should not be broken, neither should the plants be placed more than a half inch deeper than before. The proper

time for re-potting is when the roots have reached the sides of the pot and become crowded. The fresh soil put around the roots should be pressed in firmly, to make it of the same density as the ball of earth containing them. The plants should always be kept tied to stakes, and the ends of side shoots pinched off, not allowing more than two additional leaves to remain on them at any one time. The plants should also be allowed plenty of room, so that their leaves may fully expand, and receive plenty of light and air. If this is not attended to, they will grow tall and slender, and often fail to ripen their wood; besides, they will be very likely to be attacked by mildew. The plants should receive the direct rays of the sun from the time they are firmly established in the small pots.

To hasten the ripening of the plants, toward autumn pinch off the top and lower the temperature by giving them more air. A little close observation during the growth of the plants will enable the propagator to judge of their wants and the proper amount of water, heat, etc., they require. Sometimes it will be necessary to give them a little liquid manure, but this will seldom be required if the compost in which they are grown is properly made and the plants allowed good-sized pots.

PLANTING IN BEDS.

To avoid the expense of a sufficient number of pots of the various sizes required for re-potting a large number of plants several times during the season, cheap glass structures, without artificial heat, may be erected, and the soil in them made rich, into which the plants may be put directly after they have become well rooted in the small pots in which they are placed at the first potting. These beds may be made with the natural soil in the house, or they may be made of strong plank frames, deep enough to hold a foot of soil, and elevated some two feet from the

ground; in this manner the roots receive more heat than when planted in the natural soil. The same care will be required, the same watering, staking, etc., as if they were in pots. Plants of superior quality may be grown in this manner with much less expense and trouble than attends those that are grown in pots through the season.

SINGLE BUDS IN OPEN AIR.

This is another, and cheaper mode than the two preceding methods, as the expense is but trifling after the plants leave the propagating house. But when vines are to be grown in this manner, they should not be started too early, for the weather must have become warm and settled before they can be planted out.

The method is as follows: when the vines have been re-potted into the small pots, and are well rooted, they are turned out and planted in beds previously prepared, in the following manner: First make the soil rich and deep, and have it thoroughly pulverized and raked level and smooth; then lay it off into beds three feet wide, and the required length; drive down strong stakes along the sides, to which nail boards to the height of three feet or more, then across the top nail a few strips to keep all firm. Stretch oiled or plain muslin over the top, for shading the plant when first set out. When all is ready, take the plants from the house and turn them out of the pots (being careful not to break the ball of earth as it is slipped from the pots), and plant them about a foot apart each way in the beds. Now water them and place the muslin over them, when the sun shines, for at least one week; by this time they will have begun to extend their roots into the fresh soil, and the covering may now be removed, but the boards at the sides should remain all summer as a protection against wind and severe driving rains. Water the plants as often as needed; cover the soil with two or three

inches of mulch; clean straw, hay, or leaves are good, and perhaps the best for this purpose. Keep the plants tied to stakes, etc., as already directed. It is no unusual thing for plants, grown in this manner, to reach the height of six feet the first season, and they are usually more stocky than when grown all the season under glass.

It is best not to start all the plants in the propagating house at one time, as in that case they will all be ready to be re-potted or planted out the same time; but they should be started at different periods, say a week or ten days apart, making two or three lots, especially if there is a large quantity to be grown. Then the different stages of growth will enable the propagator to attend to each lot as its growth requires, and at the proper time. When the plants are planted out in the open ground, as I have just described, the material used for shading the first lot may also be used for the second, and so on, instead of being compelled to purchase enough to cover all at one time. The boards for protection are sometimes omitted, as well as the shading, and in some protected situations they may not be needed. There is also a great difference in the strength of the leaves in the different varieties, some being capable of withstanding sun and strong currents of wind much better than others; yet I believe all will grow enough better to pay for the expense of protection.

STARTING IN HOT-BEDS.

The main object in making a hot-bed is to produce artificial heat, and to have this heat continue uniformly for several weeks. For this purpose various materials are used, such as tan-bark, leaves, hops that have been used by the brewers, etc.; in fact, almost any fibrous material may be used that will continue to ferment a sufficient time to produce the amount of heat necessary to cause seeds and cuttings to grow, and keep the soil and atmosphere within

the bed from twenty to forty degrees above the freezing point, even if the atmosphere without is far below. Besides the materials for producing this heat, we must have a structure called hot-bed frames, in which we may control it when generated. These are made of planks of any required size, with a sloping top covered with sash. They may be of any length or breadth, but they are usually four to six feet wide, and of any convenient length.

The sashes are made without cross bars, and of a length sufficient to cover the frames crosswise. If the frames are six feet wide, then the sashes may be six feet long and four feet wide; but if the frames are but four feet wide, the sash may be three by four; these are convenient sizes. The size of the glass is immaterial, but six-by-eight and eight-by-ten are sizes commonly used. As there are no cross-bars to the sash, each pane of glass is made to overlap the one below it from one fourth to one half an inch, like the shingles on a house. The more the glass overlaps, the more liable it is to be broken by the freezing of the water which will always accumulate, more or less, between the panes. The glass should be bedded in soft putty, and fastened with tin, the sash well painted; but put no putty upon the upper side of the glass; if anything is needed to stop the joints between the edges of the glass and sash, apply thick paint. If the glass is well bedded in putty, nothing more than painting the upper side will be required, and they are far better without the putty than with it.

The hot-bed may be, as we have said, composed of various materials, but in any case they should be prepared some time before they are wanted for use. When leaves are used they should be obtained in the fall, and placed where they can be turned over several times during the winter, and a proper degree of moisture retained; tan-bark should be treated in the same way. Hops may often be obtained from the breweries in a state of fermentation, and then all that is required is to immediately put them into a

proper shape, and place the frames over them. But the above-named articles are comparatively little used, horse manure being equal, if not superior, to any other material for the purpose, especially when a small quantity of leaves is mixed with it. It is not necessary to describe the mode of preparing hot-beds with other materials, as the process is similar with each. The manure should be taken as fresh from the stable as possible, thrown into heaps to ferment, and worked over several times; all large, coarse lumps should be broken into pieces, and if it becomes dry, add water to keep it from becoming burnt and musty. This working over is to cause the fermentation to act upon all parts, and to give it an even texture throughout. If leaves can be had, they should be mixed with the manure when it is being worked over. One fourth to one half the quantity may be of leaves.

If the ground is quite dry upon which the hot-bed is to be made (and such a situation is always preferable to one that is wet), make an excavation one foot deep and one foot larger than your hot-bed frame; then spread in the manure and leaves in a layer about six inches thick, and beat it down evenly with the fork, then put on another layer and strike it down in the same way, and so on until you have at least two feet in depth; three feet would be still better. By spreading the manure in layers, and pressing each down separately, a more uniform degree of texture will be obtained, and consequently a more even temperature will be had throughout the bed. Bank up on the outside even with the top of the frame, with the fermenting manure, so as to assist in keeping out cold air, as well as to prevent the escape of the heat which is generated within.

Fig. 6 shows a hot-bed of four sashes when completed.

When all is neatly finished, put on the frames, close the sash, and keep all tight. If it is cold weather, cover the sash at night, and in cloudy weather also, with straw mats

or board shutters, so as to allow as little heat to escape as possible. So soon as the bed has become warm and the steam begins to rise, which will usually be in four to six

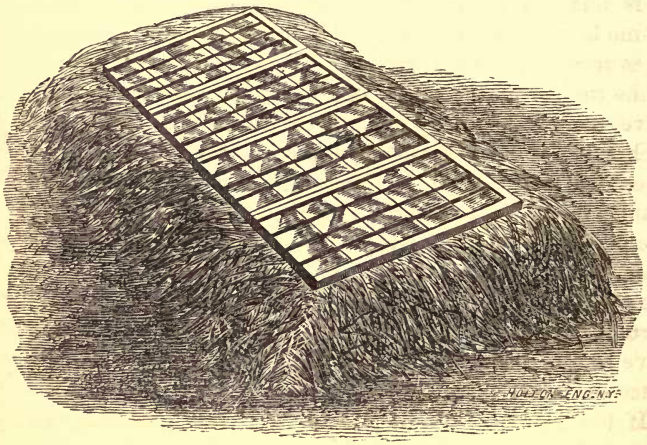

Fig. 6.

days, cover the whole surface of the manure within the frames with fine soil to the depth of four inches, and so soon as this is warmed through, the bed is ready for use.

The pots containing the buds—which should have been prepared several days or even weeks previous, and have been kept in the cellar or some convenient place away from frost—may now be plunged into the soil, nearly or quite down to the manure. The buds or cuttings, as they are called, should be made in the same manner and potted in the sand, as recommended for the propagating house.

Our main object now is the same as before; that is, by the assistance of bottom heat to excite the roots into growth before the leaves; therefore, before the leaves start, admit as much air as possible without cooling the soil or causing a too great waste of heat. "Head cool, but feet warm," is applicable here, for the first week or

two; but so soon as the buds push above ground, then the air should be kept more confined, to prevent a too great evaporation from the leaves as they expand. The same care in regard to watering should be given as when grown in the propagating house; also shade the young plants in a similar manner. We do not want to exclude light so much as we do to avoid the direct rays of the sun while the leaves are small and the plants are forming roots. Give the plants air by lifting one end of the sash a few inches whenever the weather is fine, and the thermometer goes above 90° or 95°. The atmosphere should be constantly humid, but do not so saturate the soil as to cause the plants to rot or mildew; also avoid sudden changes from extreme heat to cold, for a change of 30° to 40° will most surely give a check to the growth, and this is almost certain to be followed by disease. So soon as the plants have rooted, pot them off into two or three inch pots and place them again in the frames.

If the weather has become quite warm, they may be placed in frames where there is no bottom heat. The propagator must be his own judge in this matter, only bear in mind that a heat of 70° to 80° must be maintained to insure success; and if this can be had without bottom heat, then the latter will not be necessary.

The plants may be kept in these pots until they are well filled with roots, then they may be planted in the open ground as before directed. Some of the hardy grapes, such as Concord, Hartford Prolific, etc., have such a thick and enduring leaf that it is not positively necessary to erect frames to protect them when first planted out, yet even these will be benefited by so doing.

When the soil in which the young vines are planted is thoroughly prepared, they will require but little care during the summer, except to keep down weeds, and even this will not be needed if they receive a liberal mulch. But it will sometimes be necessary to water the vines in

locations where drouths occur, and there are but few sections entirely exempt; therefore it is expedient to be always ready for such an event, by saving an abundant supply of rain water if possible, and where this can not be done, let there be casks or cisterns made in which well or spring water may be placed to become warm by the time it may be wanted.

FORM OF SINGLE-BUD CUTTING.

Thus far I have mentioned but one form of making one-eye cuttings, yet the shape may be varied to suit the fancy of the propagator, so long as a sufficient amount—but not too much wood—is left adhering to the bud. Fig. 7 shows one style; in this the wood is cut off about three quarters of an inch above and below the bud, and the wood on the side opposite the bud is cut away deep enough to expose the pith the whole length of the cutting; the cutting is then placed in the sand with the bud upon the upper side, pressing it down horizontally, as it is shown in the cut. The advantage claimed for cutting away the wood is, that it exposes to the soil a greater surface of alburnous matter (or, strictly speaking, the cambium) from which the roots are produced.

Fig. 7.

If the roots from vine cuttings were dependent upon the exposed cambium, as with some other plants, then the superiority claimed might be conceded; but such is not the case, as a greater part are produced from around the base of the bud, or pushed through the bark from other points on the surface of the cutting.

In Fig. 8 the cutting is made square across, close at the base, or just under the bud, leaving about an inch and a half of wood above it. It is placed in the pots at the angle shown, the dotted lines indicating the surface of the

sand above the bud. The advantage of this form, if any, is that it exposes the cambium to the soil at a point where it is to be found in the greatestabundance, *i. e.*, at or near the base of a bud.

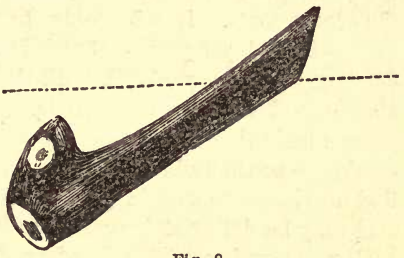

Fig. 8.

Fig. 9 is another form of making the cutting so as to expose as large an amount of cambium to the soil as possible; and further, to have a portion of the cutting go deeper into the soil than in the other forms, thereby avoiding suffering for want of moisture, if, by accident or neglect, the soil in the pot should become dry near the surface, which would destroy the cutting if made in the other forms.

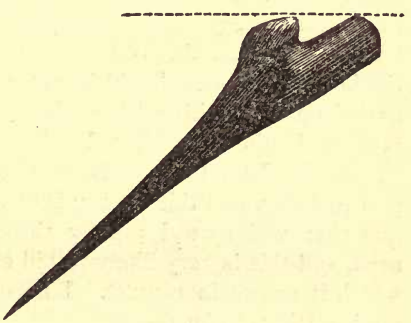

Fig. 9.

The cutting is placed in the pots in a sloping position; the dotted line above the bud represents the surface of the sand. The only objection to this shape is, that being made thin at the lower end, it is more likely to become water-soaked and decay than if left with more substance. It is, however, a good form, and has some advantages over several of the others. There is not only a great diversity of opinion in regard to the shape of the cutting, but also the best material in which to grow them. Some successful propagators use leaf-mold from the woods, others loam, charcoal and loam, burnt clay, etc., etc., but none of the materials

have the least advantage over pure sand, in which to *start* the cuttings, and a majority of propagators, if I do not mistake, use pure sand in which to place the cuttings until they form roots. It is not only the safest material for the inexperienced propagator, but it is all that is required by cuttings in the way of soil, until they are in a condition to absorb food through their roots. Sometimes it is well to place a little rich soil in the pots—an inch or so below the cuttings—so that when the roots reach that depth they will find nutriment to sustain growth; in this case the re-potting may be deferred longer than would be safe without such a precaution. This is often done by those who expect to have more work on hand than they can attend to at the proper time. Circumstances will sometimes occur when it is not convenient to start the cuttings in pots; if so, they may be put into shallow boxes or directly into the frames, but when this is done, the plank used in making the boxes or frames should be new; if not, they should be coated on the inside with ordinary water cement, mixed thin, and laid on with a brush, or covered with slate. Planks that have been used one season will usually have begun to decay, and this rotting is often the source of a fungus that will spread rapidly through the damp, warm sand, and this is very likely to kill every young root with which it comes in contact. I have known many a thousand cuttings to be destroyed by fungi, while the propagator was searching for a cause in another direction.

CHAPTER IV.

CUTTINGS OF UNRIPE WOOD.

ALTHOUGH the grape vine may be readily propagated by cuttings taken from the vine while in active growth, circumstances seldom occur when it is judicious to do so. Unless more than ordinary care is bestowed upon the young vines throughout the entire season, they will not only be feeble, but often so diseased that they never become strong and healthy, though at first they may give promise of being so.

Thousands of vines are annually produced from green cuttings, but it is questionable whether the country would not be better off, on the whole, without such vines than with them.

That good, strong, and healthy vines are sometimes produced from green cuttings, I admit, but also assert that the great majority are worthless. The facility with which vines may be multiplied in this way is a great inducement, to those who are disseminating the new and rare varieties, to use it. It requires no more skill than propagating from single buds; all that is requisite is to have a propagating house (or even a hot-bed will do), where a steady and uniform high degree of heat can be maintained.

The mode of operation is as follows: Place the vines, from which you desire to propagate, in pots, or plant them in the ground within the propagating house, and make the soil in which they are planted very rich, so that they shall not want for food. When the vines have made a new growth of a foot or so, take off the young shoots, or a portion of each; do not cut back all the shoots at one time, as this

might too severely check the growth of the vine, but three quarters of the number may be cut back, or entirely removed, without doing any injury.

The young shoots that have been selected for cuttings should be divided into pieces of two buds each, cutting them off just below a bud; the leaf adjoining the lower bud should be removed, but the upper one must be left entire. Fig. 10 shows the appearance of the cutting when ready for planting; *a* shows the surface of the soil when placed in the pots. Plant these cuttings in six or eight inch pots filled with sand, putting several cuttings in each, but not crowding them; press the sand down firmly around the cutting, leaving only the upper leaf and bud uncovered, and then put the pots within the frames, in the same manner as described for single eyes. To prevent rapid exhalation from the leaves, the atmosphere in the frames should be kept a little more confined than for ripe wood cuttings. Ventilate the frames but little until roots are produced. Keep the heat from 80° to 90°, and see that there is plenty of moisture, but not so much as to rot the cuttings or cause them to mildew. Ventilation will usually check the mildew, and withholding water prevent rotting.

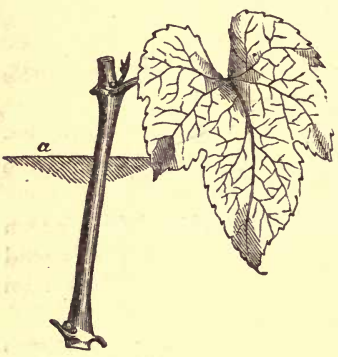

Fig. 10.

In from two to four weeks, if successful, the cuttings will be sufficiently rooted to be separated and put into small pots. An occasional examination of the cuttings will enable the propagator to determine the proper time to do this. When the roots are two inches in length, they should be removed from the large pots and placed in three-

inch pots, filled with the same rich compost recommended for other cuttings, except that the soil is mixed with sand enough to constitute one half its bulk.

After being potted they should be again placed, for a few days, in the close frames, until they have recovered from the check received in potting. The plants may now be treated the same as the single-eye cuttings, except, if you wish to produce good plants, it will be necessary to keep them under glass the whole season, as the wood will usually fail to ripen fully in the open air.

When but few plants are to be grown, or there is no lack of room, they may be started in the following manner: Take an eight-inch pot and put some broken pieces of pots or coarse gravel in the bottom for drainage, then set a four or five inch pot within it—the hole in the bottom of the smaller pot being stopped tight; fill the open space between the pots with sand, in which insert one row of cuttings, an inch and a half or two inches apart, letting the base of each cutting touch the inner pot, which is to be filled with water; enough of this will percolate through the pot (if it is of the ordinary kind) to keep the sand sufficiently moist. This is a safe mode, and will often be successful when all others fail. The pots are to be kept within the frames until the cuttings are rooted, the same as before. Fig. 11 shows the arrangement of the pots; *f*, *f*, *f* are the cuttings; *c*, *c*, sand between the pots; *d*, water in inside pot; *a*, clay with which the hole in the bottom of the pot is closed; *b*, drainage in the outside pot.

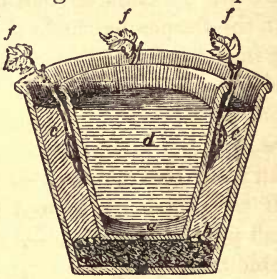

Fig. 11.

The wood of which the cuttings are made must not be too young or too old, but must be taken just at the proper time, that is, when it begins to show a slight firmness, but is not

really hard nor fully formed. If the growth of wood is very rapid, it is well to check it by pinching off the end of the shoot a day or two before it is wanted for use. After one set of cuttings has been taken off, another set will soon push out; these are to be removed when three or four inches long, cutting them close up to the main stem, so as to preserve a portion of the enlarged part at the junction; also cut off an inch or so of the small end of the shoots; these will usually grow more readily than those taken at first.

The young growing wood from vines in the open air may be used, but it does not strike root so readily, or make as good plants as that from vines grown under glass. All the varieties of the grape may be grown from green cuttings, but some root more readily than others, and there will also be a great difference in growth of the plants, some starting vigorously and continuing so through the season, while others under the same treatment will be but poor feeble plants at the best.

CHAPTER V.

PROPAGATING HOUSE.

PERFECTION should be our aim in every department of horticulture, and especially in the cultivation of the grape, and while it is not to be expected that every vine will be made to appear as regular and systematic as represented in engravings, still that is the point to be aimed at, and though we may fail with some, it is possible to very nearly reach it with all. So it is in constructing propagating houses. It is not expected that every one will have the means at command, nor would it always be expedient if they had, to go to the expense of building an extensive propagating house, unless it were desirable to produce a large number of vines, and for a number of years in succession. The size of the house will depend entirely upon the number of vines to be grown. If only a few thousand are to be produced, then only a small structure will be required; for the best vines, or the best results, are not always produced in the most expensive houses. Many a careful propagator annually produces his few thousand of superior vines with only a small lean-to house, heated with a common brick furnace and flue, and these perhaps of his own make. And while this same propagator might tell you that he would prefer, as a matter of convenience, a propagating house with all the modern improvements, still he would scarcely admit that the plants produced in his small, cheap way were any more liable to disease, or in any way inferior to those grown in the most elegant and expensive house.

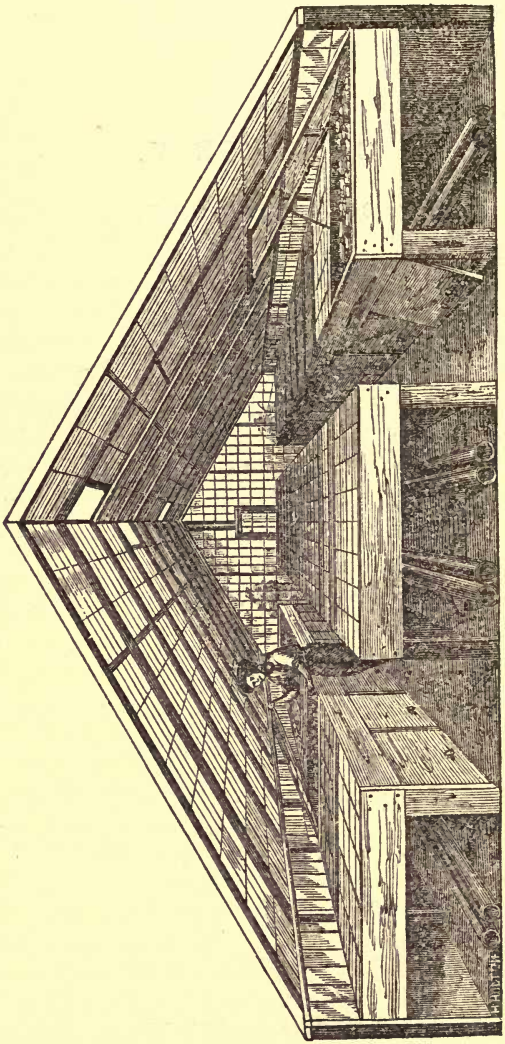

Fig. 12.—SPAN-ROOFED PROPAGATING HOUSE.

Fig. 12 gives an interior perspective view of a section of a first-class propagating house. It may be made of almost any length or width that is desired, but eighteen to twenty-five feet is the usual width for a span roof.

The sides of the house may be of brick or stone, or of two thicknesses of plank, one nailed on each side of good strong posts set firmly in the ground, and the space between filled with tan-bark or sawdust. The common cement and gravel wall, such as is used in some parts of the country, will answer the purpose as well as any other, and in many places would be most economical. The wall should be low, seldom above two and a half feet, on the top of which put a two-foot sash, which will make the eaves of the house four and one half feet from the ground. Bank up the wall on the outside, and cover the embankment with sods. The glass should be of the best quality of plate or sheet. This is preferable to cheaper kinds. Embed with putty and fasten with tin, but put no putty on the outside —use nothing but thick, pure white lead paint. The size of glass is immaterial, but if the best and heaviest is used, then the panes may be of any size, from 8×10 up to 10×16. The engraving shows the interior arrangement very minutely, except the posts which will be necessary for supporting the roof. The house stands its longest way north and south; the southern end is of glass, which may reach to the ground or stop at the height of the frames. At the north end is the furnace room, where also the potting bench, pots, etc., may be kept. The best and most economical mode of heating a large house is by means of hot water. For this purpose there are several kinds of boilers in market, many of which are very good.

The hot-water pipes should lie side by side instead of one over the other as they are usually placed in ordinary green-houses. The flow-pipe passes under one of the side frames, thence through and back under the middle one, and then under the frame on the opposite side. The return

pipe passes back along by its side, both lying on iron rests, made for the purpose. This arrangement gives eight pipes the whole length of the house, besides the elbows and the few feet that it takes to cross the end. The center frame has four pipes under it, while the side frames have but two.

The center frame may be used for starting those varieties that are the most difficult to strike, or the pipes may only pass under the two outside frames, and the center one be used for the plants when they are first placed in the small pots—or the pipes may pass under the center frame and return under the outside ones without returning as shown.

If the house is twenty or more feet in width, then for convenience the center frame should be double the width of the outside ones, and in that case the four pipes will be needed under it to keep its temperature equal to the others. Again, in place of frames through the center, a table may take its place, on which to set the plants after they become sufficiently rooted not to need so much heat or so confined an atmosphere as while young.

The inside frames are only necessary while the cuttings are rooting, and for a few days after the first shift, but they are indispensable when a number of varieties are to be grown, for the air can not be kept sufficiently confined in a large house to insure success with all. To be sure, there are varieties that will grow from single-bud cuttings without recourse to frames, but with such as the Delaware, which seldom shows any roots until the young shoots appear, it becomes a very difficult matter to prevent a too rapid evaporation from the young leaves in the open house. If this takes place, of course the cutting dies, for, until the roots are produced, the young growth is supported entirely upon the alburnous matter contained in the cutting.

The frames are ventilated by raising one end of the sash, as shown. They should be made one foot deep, and of good, sound plank. The pipes must be entirely shut in so

that the greatest heat in the house will be under the frames; but there should be small doors placed along the entire length, opening into the passage ways, which may be opened to let the heat escape into the house when necessary to raise its temperature, or to lower that under the frames. The passage ways between the beds should not be less than two and one half feet wide, and three feet is better. The frames should not be over four feet wide, as it would then be inconvenient to reach across them. A house eighteen feet wide will allow of three rows of frames, and two passage ways of three feet each; or the outside frames may be but three feet wide, and the center one, as it can be reached from both sides, may be six feet.

The places for ventilating the house may also be arranged to suit the convenience or fancy, but they should be mainly at the top. The sashes should be made in two sections—the upper one much shorter than the lower, and arranged so that it can slide down over the other, and leave an opening at the peak, as shown. Two of the sashes on the right-hand side and one on the left are shown as open. If small rollers are put in these upper sashes, they can be moved very easily. Sometimes the sashes are made very short, not more than three feet long, and then hung so that they will nearly balance; in this way they are easily managed by attaching a small rope to one end. The short perpendicular sashes at the sides of the house may be made so that they can be opened; but this will seldom be necessary, for if the upper ones are opened the heat will pass off rapidly, and sufficient fresh air will find its way into the house through the small openings, of which there will always be more or less. There are hundreds of methods of ventilating glass structures; the object of all is the same, but these I have mentioned are the most simple and will answer every purpose.

The slope of the roof should be at an angle of from 35 to 45 degrees; the one shown in the engraving is at an angle of 35 degrees, or very nearly.

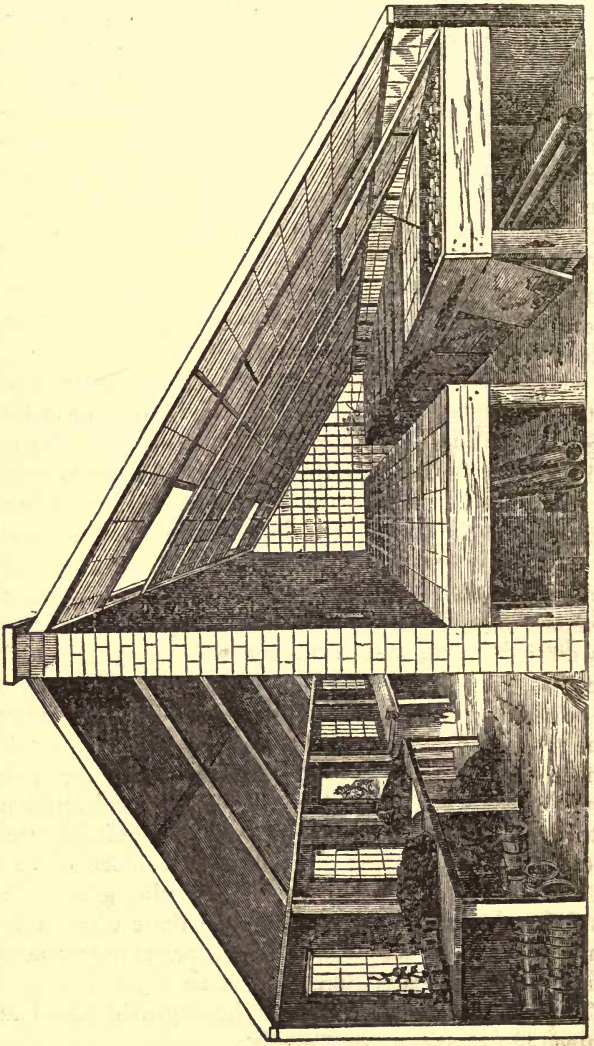

Fig. 13.—LEAN-TO PROPAGATING HOUSE.

A SINGLE-ROOFED HOUSE.

The single roof or lean-to houses are usually preferred by propagators in the more northern States, as they are less exposed to cold, being often built against a side-hill or some building; where such a protection is not convenient, then a wall is built running east and west, or nearly so, and the roof is placed against this, sloping to the south.

Fig. 13 shows a lean-to house, with interior arrangements similar to that of the span-roofed house. The furnace and general store-room is built against the north side, instead of at the end. This not only affords a protection to the wall, but gives a good-sized room for storing the compost, sand, etc. Four hot-water pipes pass the whole length of the house, as shown. The boiler and furnace are set in the room back of the wall, and the pipes pass through it into the house. The chimney may be built in the wall or be carried up by its side. When brick or tile are used for flues, then a brick furnace is made in the wall, the greater part of it within the house; but the door should open outside, so that when opened the gas from the fire may escape into the furnace room. The furnace should be placed so low that the flue may gradually rise from it to the point where it connects with the chimney, and still not come too near the bottom of the cutting frames. If the furnace is placed with its top level with the surface of the ground within the house, and the flue be made to rise one foot, rather abruptly, as it leaves the furnace, it may then be carried fifty feet with not more than six inches rise, and still it will have sufficient draft. If the house is fifty feet long, the flue should pass under the frames at the front, and return under those at the back, the chimney being near the furnace.

The point where it enters the chimney should be at least eighteen inches above the top of the furnace. Of course,

the more it rises, the more rapidly the smoke and heat will pass. The size of the furnace will depend upon the size of the house, and also whether coal or wood is used.

TO MAKE THE FLUES.

Lay a row of bricks flat and crosswise, where the flue is desired; on the ends of these place two others on their edges, and across the top lay a row flat in the same way as the bottom ones were placed. This gives the dimensions of the flue four inches by eight in the clear. But a larger flue is better, say six by eight inches, for a house of fifty or more feet in length, and it is also better to cover the top of the flues with the ordinary inch tile, as the heat passes through these more readily than through brick. No correct estimate of the cost of building a propagating house, of either of the styles named, can be given, because the price of the materials entering into their construction is continually changing.

CHAPTER VI.

CUTTINGS IN OPEN AIR.

Success in growing cuttings in the open air is often dependent upon the proper selection and preparation of the cutting-bed. The soil may be loam, sandy loam, or fine muck, with an admixture of sand—the latter is one of the best, provided it is not too wet. Any soil that is retentive of moisture, but not really wet or swampy, will answer the purpose.

A soil at least eighteen inches deep is one of the requisites of a good cutting-bed.

If the soil is naturally heavy and compact, a liberal quantity of sand, charcoal, or fibrous muck should be applied to lighten it, else it will become too hard and dry in summer, and the cuttings will suffer in consequence. A rich soil is also indispensable, for it is necessary that the cuttings should make a vigorous growth, that they may ripen a large portion of their wood and roots early in the season. This they can not do without a proper supply of food. But no fresh unfermented manure should be mixed with the soil, though it may sometimes be admissible upon the surface, after the cuttings are planted.

If the soil is not naturally rich, a liberal quantity (say enough to cover the entire surface four to six inches deep) of old, well-rotted barnyard manure, or a compost made of manure and sods, muck, leaves, or some similar materials, may be thoroughly mixed with the soil to the depth of one foot or more.

The cuttings will usually produce roots from the lower end first, therefore it is necessary that a portion of the

enriching materials should be placed as deep in the soil as the roots will extend. An application of a peck of ashes to the square rod will often be found very beneficial. It is always best to prepare the cutting-bed in the fall, so that all the materials of which it is composed may become intermingled by spring.

TIME TO MAKE CUTTINGS.

In this latitude the fall of the year, soon after the leaves have fallen, is the best time to take cuttings from the vine, but where the winters are mild they may remain on the vine until mid-winter, or even later, without injury.

When taken from the vine, the wood may be cut into the required length, or, in other words, the cuttings may be made and put away in moist soil in the cellar, or buried in some dry place in the open ground, or the wood may be put away entire, and the making of the cuttings deferred until spring.

SELECTION OF CUTTINGS.

Cuttings should be made of the past season's growth—that is, shoots that have been produced during the summer are to be taken for cuttings in the fall. These are called cuttings of one-year-old wood. That which is strong and vigorous and well-ripened is the best, although the very largest does not always make the best cuttings, nor does it root so readily as that which is of medium size. All soft, spongy, and unripened wood should be discarded, as good plants are produced only from good, healthy wood.

FORM OF CUTTING.

There is as great a variety of opinion among cultivators in regard to making long cuttings as there is respecting the form of those of a single bud. They are made of vari-

ous lengths, from four inches to two feet. I much prefer a short cutting to a long one. A cutting of six or eight inches in length, when properly planted, will make as good if not a better plant than one of twice that length.

The following is the method that I practice, believing it to be the best. About the last of November, or the first of December, I select the wood for cuttings, and with a pair of garden shears cut it up into lengths of about six inches, leaving not less than two buds upon the cutting. If the wood is very short-jointed, a cutting of this length will have three or four buds upon it; if so they are all the better, as roots usually start from each bud, but are seldom emitted the first season, in cuttings grown in the open ground, from the stem between the buds.

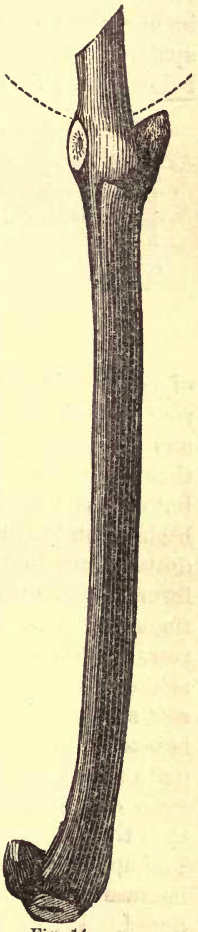

Fig. 14.

With a sharp knife smooth off the wood close up to the base of the lower bud, and cut off the top end about an inch above the bud, at an inclination as shown in Fig. 14, which gives the form of a two-bud cutting.

A three-bud cutting is the same, with an additional bud between the two.

When the cuttings are all prepared, they should be put away in the ground where they will not be frozen or become too wet. I usually set them thickly in a shallow trench, then cover them up, leaving the top bud just above ground, after which cover all up with straw to keep out the frost. So soon as the ground is settled in spring, fork over the cutting-bed, rake it level and smooth, then draw

a line across it, place the back of the spade to the line and throw out the soil, leaving a trench nearly perpendicular at the side next to the line, and a little deeper than the cutting is long; then set the cuttings upright in this trench, unless they are more than six inches long—if so, incline them—placing them about three or four inches apart, and so deep that the upper bud will be one inch below the surface of the soil. Fig. 15 shows the position

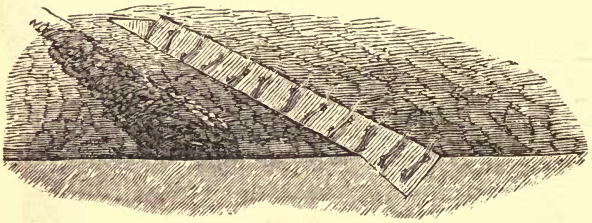

Fig. 15.

of cuttings in the trench before being filled. When the row is filled with cuttings, put in about two inches of soil, and press it down firmly around the base of the cutting; then fill up the trench evenly, just covering the upper bud, but do not bury it too deeply. This will leave a shallow basin of an inch in depth the whole length of the row—the dotted lines in Fig. 14, above the upper bud, show the form in which this basin should be left. The rows of cuttings should be about two feet apart; the soil between the rows will be about two inches higher in the middle than at the rows. The time required for the cuttings to strike root and push into growth will vary considerably. If there is much rain and the weather is warm, then they will start quite early; but if the weather is cool, they will often remain comparatively dormant until June, and even later than this, and then start and make a good growth by fall. The upper buds should be carefully preserved from injury, because it is from these that the shoots are usually produced. When the cuttings have made a grow h of four

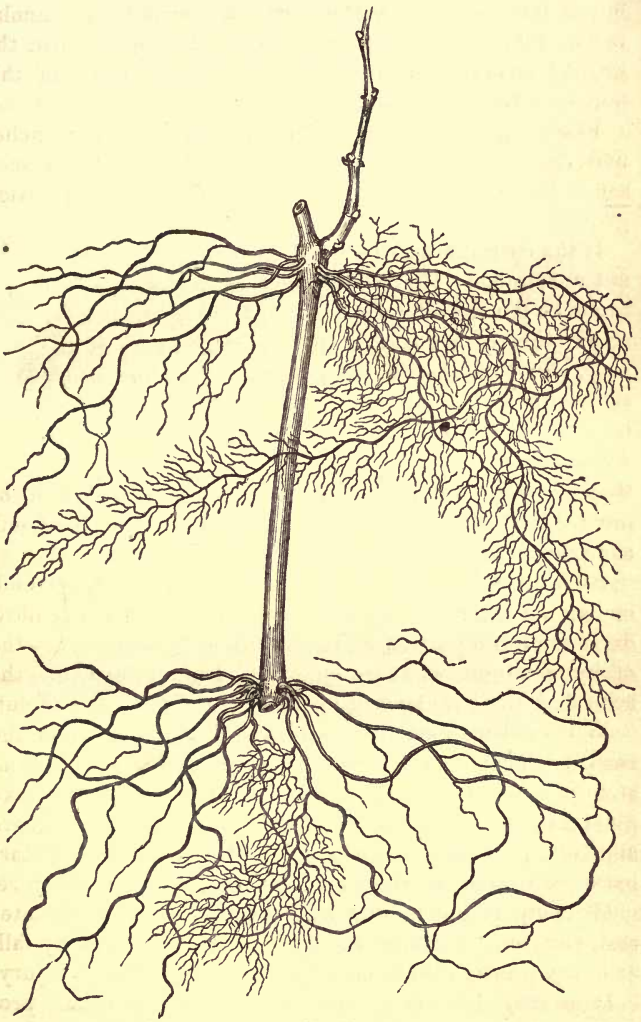

Fig. 16.

or five inches, the ground should be leveled so that the upper buds on the cuttings will be covered an inch or more; then, if two inches of mulch are spread over the ground between the rows, it will keep it moist and promote the rooting of the cuttings.

Roots from the lower bud will usually be produced first, but soon after the base of the shoot is covered, a set of roots will issue from near it, which will assist the growth.

If the cuttings make a good growth—four to six feet is not uncommon; they should be tied to stakes, as this will promote the ripening of the wood. Fig. 16 is a fair representation of a two-eye cutting at the end of the first year. In this sketch the roots and top are necessarily shown much shorter, in proportion to the length of the cutting, than they were on the plant from which the drawing was made, and the small rootlets cover all the roots, while they are here represented on only a part. When roots have these small appendages attached to them in abundance they are called fibrous-rooted.

All vines when grown in congenial soil will have more or less fibrous roots, for it is through these that the plant derives a large portion of its food from the soil. They are often as minute as those shown in Fig. 16, and they are soon destroyed if exposed to the air.

When cuttings are grown in the above manner they are readily changed into one-eye cuttings by severing the stem just under the upper tier of roots; this will give as good a one-eye plant as though it was grown under glass and from a single eye. Fig. 17 shows the plant after the lower section of the roots have been removed.

Growing plants in this way involves a waste of buds, and, moreover, cuttings are not so certain in the open air as in the propagating house.

It is very difficult to make some varieties grow from cuttings in the open air, while others do so readily. Some

kinds require more moisture than others, and if planted in a situation where they will receive an abundant supply throughout the season, they will often produce as strong

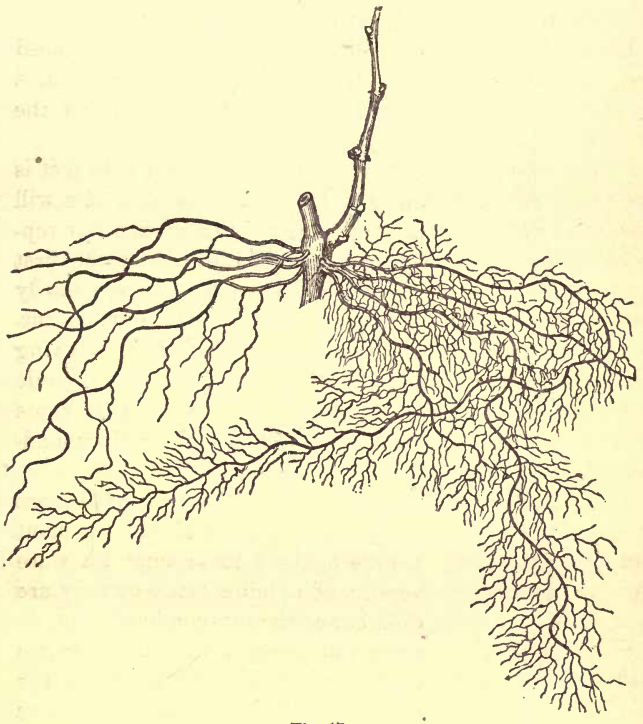

Fig. 17.

plants as the others will in ordinary soil. It is also sometimes advisable, with those kinds that do not strike root readily, to plant the cuttings in the fall in the same manner as we have described for two-eye cuttings, then cover the bed with straw, so that it shall not freeze. In the spring remove the straw, leaving enough on the bed to keep it moist.

Where the soil used for the cutting-bed is naturally dry and porous, any or all the varieties may be planted in the fall, provided they are protected from frost during the winter.

Fig. 18.

That there are certain varieties of the grape that grow more readily from cuttings than others, in the open air as well as under glass, is well known to every vineyardist. But a variety that is very difficult to propagate by cuttings in the open air in one section of the country may grow readily in another. Climate has much to do in this matter, and while I do not wish to convey the idea that there are certain circumscribed spots where a particular kind will grow from cuttings when it will not do so elsewhere, I wish to remark that the same skill that would produce a good plant of some varieties in Missouri might fail to produce one in New York. Knowing this to be the fact, we are enabled to account for the diversity of opinion often expressed by different cultivators coming from widely separated sections of the country, for each speaks of his own experience or observation in his own particular locality; and while each may state the truth, their stories will not agree, and one may exactly contradict another.

MALLET CUTTINGS.

The mallet cutting is usually made by selecting only the lower portion of

the one-year-old cane, and by cutting through the two-year-old wood, leaving a small piece of it attached, so that the whole resembles a small mallet. Fig. 18 shows the form of the mallet cutting. The advantage derived from the presence of the piece of old wood is not, as is sometimes stated, because roots are more readily produced from it, but because there are several buds at the point of junction of the old and young wood, and, consequently, a larger deposit of cambium than where there is but a single bud. The piece of old wood assists in protecting these buds until roots are produced.

The number of cuttings that can be obtained from a vine is necessarily but few, as only one is made from each cane, and it will depend very much upon the mode of training whether it will do to cut away the old wood for this purpose. The cuttings should not be made more than ten or twelve inches long; they are sometimes made much longer, but it is unnecessary, as too much wood will often prove injurious.

There are some varieties of grapes, for instance the Delaware and Norton's Virginia, that grow much more readily from mallet cuttings than from the ordinary two or three-bud cuttings. Sometimes the laterals that have been allowed to grow unchecked, and have produced canes of considerable size, are used, leaving a piece of the main cane attached to form the mallet.

The mallet cutting is perhaps the most ancient form of cutting. The Romans made their cuttings in this manner, and they were called *malleolus*, from the Latin *malleus;* hence our word mallet. The French vineyardists still adhere to this form of cutting, and with them they are called *crosetts.*

There are some vineyardists in this country who, to extend their vineyards, depend almost entirely upon the few cuttings of this form which they are able to get from their vines, and there is no doubt but that excellent vines may

be grown from such cuttings; but it is equally true, that other portions of the vine will, with proper care (though not always quite as readily), make vines equally as good.

It matters little what form of cutting is adopted, nor does any particular portion of the wood possess any superiority over another, provided it is thoroughly ripe and healthy. The requisites are: to keep its vitality unimpaired from the time it is taken from the vine until it is planted, then give the cuttings a position where they will secure plenty of heat and moisture with a full supply of nutriment to sustain them when they begin growth.

CHAPTER VII.

LAYERING THE VINE.

THE propagation of the vine by layers is one of the most certain and convenient methods in use; and while the number of plants to be obtained from a given quantity of wood is not so great as in the other methods, yet the size of a one-year-old plant produced by layering will far exceed that produced in any other way.

A layer is a cutting which is left attached to the parent plant, and derives nourishment therefrom until it has produced separate roots of its own. Much discussion has taken place upon this subject among cultivators of the grape, some asserting that in the first stages of the growth of the layered plant it was entirely dependent upon the parent for its food; consequently the roots that are produced later in the season from the layer itself do not fully ripen, and are of but little value to the young plant when separated from the parent. For more than two thousand years layers have been recommended and condemned by different authors, and all have some plausibility in their arguments. But the facts are that, when properly grown, layers make as vigorous and healthy plants as are produced in any manner.

When vines are to be grown expressly for layers, they should be planted six or eight feet apart, in very rich soil, as the object will be to get a large growth of wood without regard to fruit.

The vines when planted should be cut down to the ground, or within a few inches of it, and only one cane be allowed to grow the first season, and this must be kept

tied to a stake. In the fall or winter this should be cut back to within three or four buds of the last season's growth; this number of buds is left to guard against accident, but only two are to be allowed to grow.

The next spring the two buds that push the strongest are to be allowed to grow, and should be kept tied to the stake as before. If the vine this, the second, season grows strong, and makes a growth of from six to ten feet, it will do to commence layering it the next spring, at which time it will be in its third season after planting. But if it should not produce a strong growth, then one cane should be cut entirely away, and the other to three or four buds, allowing but two to grow as before, and defer the layering until the fourth year. For there is nothing gained by taking layers from a vine until it is strong enough to make good plants. But so soon as the vine has made two strong canes, of from six to ten feet long, whether it be the second or third year, it may be layered.

HOW TO LAYER THE VINE.

If the wood that is to be cut off is wanted for cuttings, then the vine may be pruned in the fall; if not, defer the pruning until the last of February or the first of March. Select the largest cane for the layer; if it be ten feet long it should be cut back to six or seven feet, but if not so long then cut it back still more; then cut the other cane down to within three or four buds of its base. After the buds begin to swell in the spring (or even if they have grown an inch or two it is no matter), layer the cane in the following manner: Dig a trench from four to six inches deep, six inches wide, and of a sufficient length to receive the cane; now bend it down and fasten it in the trench by hooked pegs, or by laying a stone or two upon it. The bottom of the trench should be level and the vine laid flat in the bottom, and *not* turned up at the end as is some-

times recommended. The cane may be bent sideways, in a circular form, and it will be a benefit to it, as it will cause the buds to push more evenly than if laid straight, but that portion in the trench should still be as nearly level as possible.

Now let the vine remain until the shoots have grown from three to four inches, then select those that are wanted and break off all others; those that are allowed to remain should be as evenly distributed as possible through the entire length of the layer.

Four to six are all that should be allowed to grow on a cane six or seven feet long. If allowed to grow, every bud will make a plant, but not a good one; the less number, the better they will be. Fig. 19 shows the layer in the trench after the superfluous shoots are removed, also the roots as they will appear later in the season; B, C, the young shoots starting from the buds on the main stem. The first roots push from near the buds, as

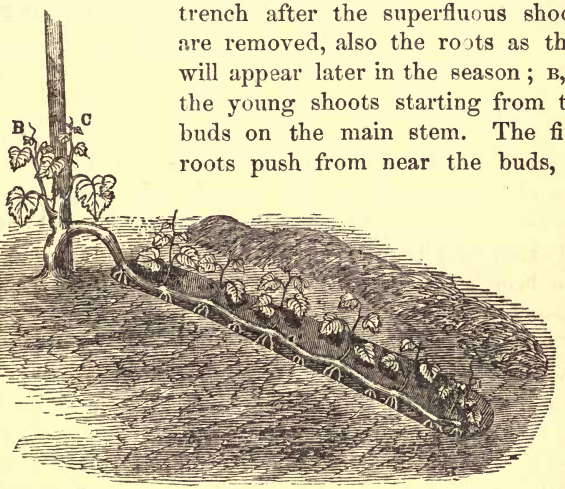

Fig. 19.

with cuttings, but afterward they will start from between the buds.

When it has been decided what shoots shall be allowed to remain, then good stout stakes should be put down by

the side of each; and so soon as the shoots are from six to ten inches high, they should be tied up. And at this time a little soil should be drawn into the trench, enough to cover the vine an inch deep will be sufficient. In a week or ten days an inch or two more may be put on, and so on at intervals of a few days, or at each hoeing, until the whole trench is filled up. If it is filled while the shoots are very young, it will cause the part below ground to rot. Each of the young canes should be kept tied to the stakes, and if a particular one takes the lead and appropriates too much of the sap to itself, it should be checked by pinching off the top.

The canes nearest the parent vine, and the one at the extreme end of the layer, will usually grow much more rapidly than those between; if so, they should be checked before they have gone so far as to weaken the other plants.

Hoe the ground often during the summer, or cover it with a mulch to keep down the weeds. The cane that was cut down to three or four buds should be allowed to produce two or three shoots; these are to be tied to the stakes shown in the engraving. Next season the same operation may be repeated, and if the vine has grown very strong, two canes may be layered instead of one. After layers have been taken from the vines two or three seasons in succession, it is best to let them pass over one season without taking any layers from them, for if layered every season, they will soon become exhausted. Any vine that has a young shoot which can be made to reach the ground may be layered, but it is not advisable to take layers from vines that are planted for fruiting.

When only one vine is wanted from a plant, then a branch may be bent down into a short trench in the spring or fall, and covered up at the time, leaving only the end above ground. In this way a very strong vine will be produced the first season.

The layers may be separated from the parent vine at the

end of the first season or the spring following. In taking them off cut them loose from the stakes, then lift them, using a fork instead of a spade, and proceed to cut them apart. First cut the layer close up to the parent vine, and then cut off that portion that was above ground and has no roots; the next cut should be between the first and second upright shoot near the first, and so on to the end, leaving those roots on each plant, below it or toward the parent vine. I am thus particular in showing how the vine should be separated, because I have seen layers so separated that the roots left on them were nearer the top end of the layer than the shoot was, and the sap would have to reverse its course and descend the layered cane to reach the new vine. It will do so sometimes, but not readily. Other methods are practiced in making layers, but I believe those described are the best.

CHAPTER VIII.

GRAFTING THE GRAPE.

THE propagation of the grape vine by grafting is probably as old as its cultivation, and many of the modes practiced at the present time are accurately described in most of the ancient works on gardening and agriculture. But with all the information which we have derived from both ancient and modern authors, it still seems to be generally considered a rather difficult if not uncertain method of propagation. On account of the peculiar structure of the wood of the vine, a lasting union is seldom obtained when grafted above ground, and is far from being certain even when grafted below the surface by the ordinary method. When we compare the benefits to be derived from grafting the vine with grafting the pear, apple, etc., it appears to be of little value, because the vine may be readily grown from cuttings of almost any portion of the wood, while the latter produce roots from cuttings only sparingly, even with the greatest care and under the most favorable circumstances, but they may be propagated very easily by grafting and budding. Thus it appears that nature has provided a way for the rapid multiplication of every species and variety of plants, but she has left it to man to discover the way and means. There are circumstances constantly occurring under which it would be quite desirable to graft the vine; for instance, when we have a new and valuable variety which we wish to multiply as rapidly as possible; to do this we must produce wood for the purpose, and if we can produce wood more rapidly by grafting than by any other means at command, then it becomes very import-

ant to know how to perform the operation successfully. There are usually in every garden where grapes are grown, inferior varieties which it is desirable to exchange for better, and if we employ grafting as a method of propagation, then these otherwise worthless vines may become valuable as stocks on which to graft better kinds; and if by the use of these we can make every bud to produce a shoot of from five to twenty feet in a single season, of larger and better wood than we can by any other means, and that, too, without the aid of any artificial heat, it becomes very important to know how to do it. Sometimes it would be desirable to change a whole vineyard from an inferior variety to a new and superior one, and if the operation is judiciously performed, it can be successfully done; but I will consider this further on. The time generally selected for grafting the vine is early in spring, before the vine starts, or after it has started and made a growth of a few inches; both of which I have found highly objectionable; for if grafted early, the operation must be performed several weeks before the vine starts, so as to allow the graft sufficient time to form a union with the stock before the latter starts, or else the excessive flow of sap will drown the graft. This early grafting is very difficult in a northern latitude, where the ground thaws out only a very few days before the sap begins to flow. It is always desirable to graft the grape below ground. If we wait until the vine has begun to produce leaves, and the sap has thickened and flows less rapidly, then by cutting down the vine to receive the graft we give it a severe check, which often destroys it; and if not entirely killed, it is so much injured that it does not afford sufficient nourishment to the graft to produce a very strong growth. Besides, if hot, dry weather sets in, the graft is almost sure to fail.

Another reason why grafts do not unite more readily with the stock at this season is because the sap in the vine is in a state of active circulation, and in a different condi-

tion from that in the graft, for in the former the cambium (or elaborated sap) is of recent formation, while in the latter it was formed the season previous; consequently there is but little affinity between the two.

These are but a few of the difficulties that I have had to encounter when grafting at these seasons, and in the ordinary manner. To avoid them I have practiced with perfect success the following method: in the fall, after the leaves have fallen, and any time before the ground is frozen, say in October, November, or December, varying according to latitude, dig away the soil from around the stock (which may be of any size, from one half inch to two inches in diameter) to the depth of four to six inches; then cut it off, and split in the ordinary manner for cleft grafting; make the graft of one eye with about four inches of wood, and insert it in the stock, being careful to have the inner bark of the stock and graft meet, then tie in the graft by winding around the stock some bass-bark or strong twine enough to hold it firmly in place. Fig. 20 shows the graft inserted and ready for tying. Next, throw in soil enough to fill up around the graft, leaving the bud just above the surface; then put a flower-pot (a box will answer the purpose) inverted over the graft, as seen in Fig. 21; then bank up, *d*, *d*, around the flower-pot to the top, but not over it: now put on some straw, *e*, say six inches deep, and cover the earth, *f*, over all. In this manner the graft is perfectly protected against the frost, and it has all winter to perfect a union with the stock, and

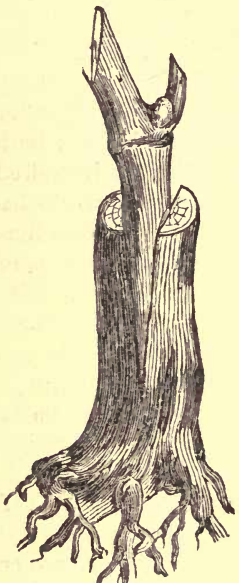

Fig. 20.

by spring it is ready to grow. It should not be uncovered until the cold freezing weather is over. It is necessary that a box or flower-pot should be placed immediately

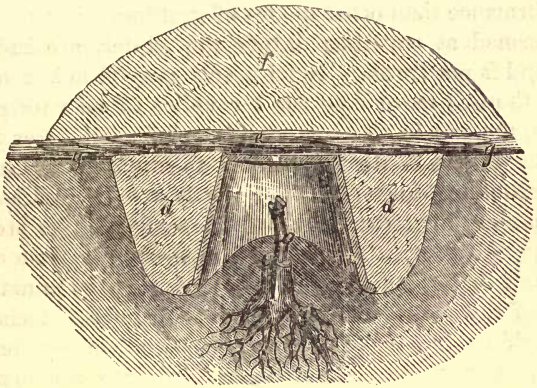

Fig. 21.

over the graft, so that when it is uncovered in spring, the graft will not be disturbed by digging down to uncover it; and it also protects the graft from being injured by water running down it and getting in between the graft and the stock. I have sometimes used grafting wax for covering the junction between the stock and graft, but having succeeded just as well without, I abandoned its use; besides, I have sometimes noticed that the wax injured the graft when it came in contact with it. Grafting clay may be employed with safety, but I do not consider it necessary to use anything but the bass-matt, and then put in the soil. The twine or bass strings will usually become so weakened during the winter that they will give away when the stock commences to grow. One-year-old wood should be used for grafts, and only that which is firm and well ripened. If the wood is very short-jointed, the grafts may be of two buds instead of one, but usually one is sufficient.

Grafts inserted in the fall in this manner will make almost as strong a growth as the original vine would have

done if it had not been grafted; besides, the operation can be performed at a season when there is usually not so much business as in spring, and it requires no more skill in its performance than other modes of grafting. It can also be performed at any time during the winter, provided the ground is not frozen. But I prefer early in fall, as in that case there is more time for the union to take place; besides, the sap in the roots of the vine remains longer in the fluid state in the fall than in the top, as may be seen by examining the roots after the leaves have fallen, and when no sap is observable in the branches. This is owing to the fact that roots, in a great measure, are out of reach of the frost, which has checked the flow of sap in that portion of the vine above ground. All the roots of the vine are seldom in a perfectly dormant state, consequently the sap is always ready to flow upward into the branches whenever they are not frozen. The vine, as well as nearly all woody plants, continues to expand its buds during the winter months. And if there were no such action as this, then there would be no production of new fibers and callosities, which every practical horticulturist must have observed as taking place, especially upon the roots of trees and plants that have been transplanted in the fall. These facts led me to try the grafting of the grape early in the fall, and the results have been all that I could wish; for when the grafts have been properly inserted, I have found them in the spring, without an exception, to be firmly united to the stock.

When the grafts have made one season's growth they may be cut down and used for grafts or cuttings, or they may be layered. If sprouts should come up from the stock they should be immediately removed, as they would rob the graft of nourishment.

When there is a scarcity of stocks for grafting, an old vine may be layered, as shown in Fig. 19, and instead of taking up the layers the young canes may be grafted in

the fall, inserting the graft as near the layered cane or roots as practicable. And when the grafts have made one season's growth they may be taken up and separated, or be again layered and several vines produced from each. But in grafting the one-year-old canes the cleft or wedge-graft should not be used unless the canes have grown very strong, and are at least five-eighths of an inch in diameter; but instead of it, splice-graft them as follows: select one-year-old wood for the grafts as near the same diameter of the stock as possible; cut the stock obliquely upward and the scion downward, with a corresponding inclination, so

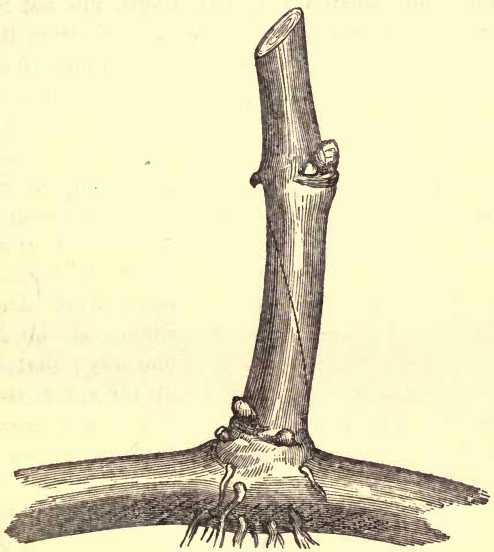

Fig. 22.

that the two shall fit nicely together, care being taken that the bark on one side, at least, of the graft and stock shall meet exactly. Fig. 22 shows the manner in which they are united. Bind them snugly together, and proceed to cover, etc., as with the cleft-graft.

Sometimes it is desirable to graft a whole vineyard, and if the vines are young and healthy it is perfectly practicable to do so; but if the vines are, as is often the case, old, stunted, and diseased, it is better to dig them up and plant new ones. Because, if very large and old vines are cut down and grafted, a large portion of their roots is very likely to die in consequence of the severe check they receive by having all the top removed; and these dead and decaying roots will have a tendency to convey disease to the whole plant.

In these days, when men are planting acres of comparatively new and untried varieties, there will be, without doubt, hundreds of vineyardists who will soon discover that they have many sorts whose fruit will not pay for cultivating the vines. Yet many of these varieties will make good stocks on which to graft other kinds. Where a number of vines or a vineyard are to be grafted, and they are to be grown for fruit only, I would not depend entirely upon the stock for permanent support, but I would layer a portion of the graft when it had grown one season. The vines should all be layered one way; that is, take up the stakes to which the grafts have been tied, and set them in a line one side of the vines and about two feet off; then dig out a trench five or six inches deep, from the vine to the stake; bend down the vine into it, and bring up the end and tie it to the stake,

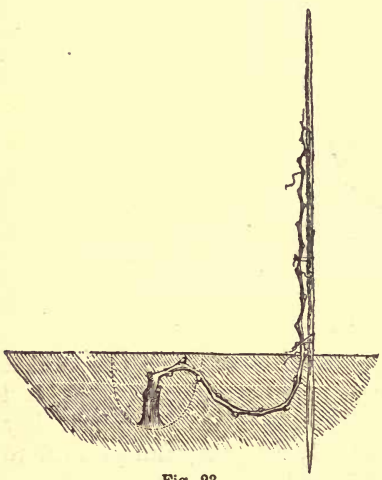

Fig. 23.

being careful not to break the graft from the stock; fill up the trench, covering the vine except the end tied up.

Fig. 23 shows the manner of layering; the cross line shows where the vine should be cut off. All of that portion of the young cane that is covered will throw out roots the next season, and very materially assist its growth; besides, it will be firmly established upon its own roots, and not dependent upon the stock for support. In the above manner a whole vineyard may be changed from an inferior to a superior variety in one season, and at a trifling expense. It is often the case that the best varieties are naturally slow growers, and the most inferior kinds the stronger, so that the grafting may be beneficial not only in exchanging a poor variety for a good one, but will very much assist the latter in growth.

There are many other modes of propagating the vine, such as budding, summer-grafting, inarching, etc., besides dozens of modes of layering and grafting; but few of them are of any practical use to the vineyardist, and none superior to those I have given.

CHAPTER IX.

HYBRIDIZING AND CROSSING.

These are operations that should demand the attention of every one who undertakes to produce new varieties. If these are artificially performed, improvements are more certain than if we depend wholly upon the natural variations occurring in vines grown from seeds which have not been influenced by artificial fertilizing.

Many of our best varieties of grapes as well as other fruits owe their superiority in a great measure to the careful manner in which the flowers of the parent plant were fertilized.

The two words hybridizing and crossing are used indiscriminately by many writers in this country who follow the European custom of calling every plant that shows a mixture of two varieties a hybrid. This is an error which we should avoid, for although the mode of operation is in both instances precisely the same, the results are entirely different.

A hybrid grape, properly speaking, is a mixture of two distinct *species*, not of two varieties of the same species. For instance, if we should take an Isabella grape, which belongs to the *Vitis Labrusca* species, and the common frost grape (*Vitis cordifolia*), and by fertilizing the one with the other produce a plant with the characteristics of both parents, we should then have a proper hybrid. But if we should fertilize the Isabella with the Concord we would have a *cross* between two *varieties* of the same species. Hybridizing, then, is the mixing of two *species*, and crossing or cross-breeding (as it is termed) is the mixing of two *varieties*.

True hybrids are generally forced productions, but cross fertilizing is constantly going on naturally among nearly all cultivated plants.

During the last few years many new varieties of grapes have been brought to notice that are claimed to be true hybrids, and doubtless many of them are; but it is to be regretted for the cause of science that nearly all of these are in part a mixture of the varieties of *Vitis Labrusca* or its direct offspring; for of all the known native species this is the most variable, producing of itself, without being fertilized by other species or varieties, almost every conceivable shape, color, and quality of fruit, as well as a great variety in leaf, stem, and growth.

I think that I may safely assert that until some other varieties and species have been operated upon than those heretofore employed, but little reliance can be placed upon the assertions that are constantly being made about this or that grape being a true hybrid.

We know that plants in a state of nature generally perpetuate their species and varieties with great uniformity. Yet a slight change is sometimes observed, and it has been upon these variations that pomologists and florists have mainly depended as the starting-point from which they produce their innumerable varieties.

The effect produced by change of soil and climate upon plants when removed from their native habitats has long been observed, and their variations turned to valuable account. Although these changes have been slow, yet by the preservation of them we are indebted to most of the valuable fruits and flowers now in cultivation.

When plants are removed from one country to another, and become acclimated, the effects of this change will sometimes show itself in the seedlings grown from them in a distinct and wonderful manner, so much so that some are inclined to think that it is the result of accidental hybridization. These phenomena lead many to believe

that they have a hybrid variety, when it is only a variation produced by natural causes.

If we have a number of fruits which reproduce themselves without variation, it is not positive proof that they are distinct species. But it only goes to show that the natural forces of the plants are perfectly balanced.

We see this principle fully illustrated in the different breeds of cattle, sheep, etc., which are descendants of an original species, but are now divided into breeds, as they are termed, each of which perpetuates its distinctive features unless some disturbing cause is allowed to interfere and destroy the established character.

The case is very similar with plants, for we often possess varieties that have all their functions so fixed and balanced that they reproduce themselves from seed, generation after generation, if not disturbed by being brought into close contact with other and different varieties of the same species, or by a too great change of soil, culture, or climate. But when there has been a disturbance of these forces either by hybridizing or cultivation, and the functions of generation have been disarranged, then variation begins, and it becomes difficult to decide whether hybridizing may or may not have produced this change.

Suppose we fertilize the Isabella grape with the Sweet Water and the result is a white variety, would the simple fact of its being white be a proof that hybridizing had been accomplished? No, not at all, for there have been plenty of white varieties raised from the seed of the Isabella without its being brought in contact with any white kind.

I fruited several seedlings of the Isabella the past season, and two of them gave fruit that in appearance were exact types of the Delaware, yet the vine from which the seeds were gathered to produce these seedlings was not within twenty miles of a fruiting Delaware; but had I fertilized an Isabella with the pollen from the Delaware and produced such fruit as the result, it would have been pro-

nounced by nine out of ten casual observers to have been a perfect success in crossing these two varieties. But as the facts are, I know that no such causes did exist, and that the production of the fac-simile, in outward appearance, of the fruit of the Delaware was only the result of the inherent variableness of the parent variety.

To convince us that hybridization has actually taken place, we need to see more than one of the prominent characteristics of both parents mixed in the offspring.

Again, if the offspring should appear to be only a reproduction of the mother plant without variation, it would not prove that the hybridizing process had not been effectual. But it would only show that there was a predominant power in the mother plant to reproduce itself, and the influence which the artificial fertilizing had produced was entirely hidden in the present generation of seedlings, but in the next generation it might show itself distinctly.

A good test to determine whether a plant is a true hybrid or a mixture of two species is to plant a quantity of its seeds; a portion of the seedlings thus produced will be pretty sure to show more prominently than others some of the characteristics of one or the other of the parents; or, in other words, the mixture will again separate, and a part will return each to its original progenitor.

There are at the present time several varieties of grapes under cultivation which are called hybrids; the most noted are Allen's Hybrid, and a number of varieties under the name of Rogers' Hybrids. These are said to be the result of fertilizing one of the varieties of the *Vitis Labrusca* with one of the *Vitis vinifera*, the former being a native species, and the latter a foreign one. By growing a quantity of seedlings from these sorts, we may ascertain if they are true hybrids, as claimed, for, if our position is correct, a portion of the seedlings will be more like the *Vitis Labrusca* than their parents, while others will show more of the characters of the *Vitis vinifera*.

These difficulties in determining the cause that may have produced a certain change, ought not to deter us in our efforts at hybridizing.

The world cares but little how a thing is produced, or where it is from, but is only interested in the results. Our greatest danger as cultivators lies in the fact, that partial success will often direct our thoughts into a region of false theories, from which it is difficult to extricate ourselves without unlearning all that which we have previously learned.

In all our efforts at hybridizing, attention should be given to the adaptation of the plants to the circumstances under which they are to be grown.

If it is our object to produce a plant for this latitude, we should avoid, if possible, crossing with a variety that ripens late, or is otherwise unsuitable. The aim in all our operations should be, to develop those qualities that are most valuable, and discourage those that are not; for these intercrossings will often produce an individual variety more valuable to us than either of the parents. Again, we may cross two superior varieties, and the result will be a kind that is very inferior. But it is this very uncertainty that makes the operation of fertilizing so fascinating. If we could know exactly what the results of our labor would be, it would be robbed of half its charms.

It is undoubtedly the fact that true hybrids have been, and can be produced; even if they had not been, none will deny that the crossing of varieties is often of the utmost importance to grape growers, therefore I can not do less than urge all to try it often and persistently.

MODE OF OPERATION.

That we may proceed understandingly, let us examine the flowers of the grape. Fig. 24 shows a flower as it is expanding; A shows the five petals cohering together as they are lifted up and cast off by the stamens; the petals do not open, as in the rose, lily, and most other flowers, but drop off without expanding. Fig. 25 shows the flower after the petals are gone; the five stamens are now surrounding the center of the flower; the little knobs at their summits (B) are called anthers, which produce a fine dust called pollen—this is the fertilizing material which we wish to control. Soon after the flowers open, or the falling of the petals, this pollen is carried by the air or insects to the stigma (C), which is the terminal point of the pistil, placed in the center of the flower. The surface of the stigma is covered with a viscid substance, to which the pollen adheres; and so soon as the pollen lodges here, it penetrates the stigma and passes down through the pistil to the ovules or undeveloped seeds. Now, this operation goes on without the assistance of man, in all perfect flowering varieties of grapes; but when we wish to cross or hybridize a variety, we fertilize its stigma with the pollen from another plant, and prevent the pollen of the flower fertilizing its own stigma. To do this, so soon as the flowers open, we cut off the anthers with a small pair of scissors, leaving the flower as seen in Fig. 26 (D, stamens with the anthers removed), then take the pollen from another variety, and dust it over the stigma. This last operation is performed with a fine camel's-hair pencil. Suppose we wish to produce a cross between the Union Village and the Delaware, which would certainly be very desirable, as the former is very large but not

Fig. 24.

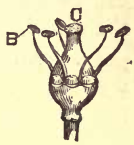

Fig. 25.

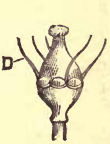

Fig. 26.

remarkably good, while the latter is small but most excellent; and suppose we choose the Union Village for the fruiting parent. Now, it is very desirable that they should come into flower at nearly the same time; but if they do not, it is positively necessary that the one to be fertilized should be the last to bloom; for the pollen can be kept good for a few days by cutting off the anthers when in a proper condition, putting them in fine, soft paper, placing the whole in a bottle, and corking it up until wanted. When the plant, the pistil of which is to be fertilized, comes into flower, it can not be retarded, and the operation must be performed as the blossoms open—although the period of blossoming may be hastened or retarded if the vine is operated upon early in the season for that purpose. When the Union Village shows signs of flowering, we should watch it closely, and so soon as a flower drops its petals, the anthers should be immediately cut away, and some pollen from the Delaware applied to the stigma. Operate upon every one that is sufficiently advanced to admit of it, and then inclose the entire bunch in a gauze bag, to prevent insects from bringing pollen from other flowers, which they often do, and thereby interfere with our operations.

If a portion of the flowers were operated upon, say at ten o'clock A. M., by three or four in the afternoon another set will be open, at which time they should be fertilized in the same manner, and more pollen should also be applied to those operated upon in the forenoon, as they may not have absorbed that first applied.

The flowers do not open all at one time, neither is the stigma always fertilized by the first application of pollen, but it should be repeated a number of times during several days. When the fertilization has been complete, the miniature grapes commence swelling, and their growth proceeds rapidly.

The gauze covering should be removed so soon as all the

flowers on the bunch show that they have been fertilized. Mark the bunch, and take care that no worm or insect injures it during its growth.

It is best to thin out the flowers before they open; cut away at least one half the number, as it will be more convenient to operate upon those left. Besides, the berries will have more room to grow, and will be larger and mature better than if all were left on.

When the fruit is ripe, gather it, and proceed the same as recommended for seedlings in the preceding chapter.

CHAPTER X.

TRANSPLANTING.

VINES, whether grown from cuttings in the open ground or under glass, will often require one season of nursery culture before being planted in the vineyard. In such cases they should be transplanted from the cutting-bed, or, if grown in pots, they should be taken out, the earth shaken from the roots, the tops and roots shortened, and then planted in the nursery. This rule does not apply to well-grown layers, nor to extra large one-year-old cuttings, but only to such vines as are usually produced in nurseries. The benefits derived from transplanting young vines should not be overlooked. Vines, for instance, that are grown in pots, generally have a mass of roots that are crooked and distorted by being confined in a small space, and which need to be separated, their ends cut off, and sometimes a portion of them taken out entirely, and then planted where they can have special care, such as mulching, watering, etc., or they will make but little progress. It is much more convenient to do this when planted in a nursery than when scattered over a vineyard.

A large portion of the vines that are produced from cuttings in the open air will have but few roots, and sometimes these will be nearly destitute of small branching ones; but if they are taken up and have their roots shortened, and are planted again, they will throw out a number of roots from each of the original ones. The same remarks apply to one-bud cuttings in open air.

But the most important result derived from the nursery culture is, that the vine becomes sufficiently strong the second year to allow it to be placed at the proper depth

when planted in the vineyard. This can not be done with small one-year-old plants without detriment to their future growth. To be sure, they can be planted in the bottom of a shallow trench, which may be left open and not filled up until they have made a strong growth; but this will require extra care in cultivating; besides, in most soils, these trenches would have to be cleaned out after every heavy shower. Vines may be left in the cutting-bed until they are two years old; some cultivators do so, but they do not make so good plants as when transplanted. Sometimes they are left there for several years, or until they are wanted for planting or selling; but such plants are of little value after the second year, as the roots are usually so long that it is impracticable to take them up entire, and they are cut off, leaving all the fibrous roots in the ground, and the remaining roots are so old that they possess but little power to produce new fibers. Had they been transplanted they would have been furnished with an abundance of fibrous ones. For these and other reasons I believe it is better to transplant the one-year-old vines from the cutting-beds or pots to the nursery preparatory to their final planting in the vineyard. The soil for the nursery should be in the highest state of cultivation, containing all the manurial ingredients necessary for the growth of the vine, in addition to being deep and thoroughly pulverized. It is expected that while the young vines are in the nursery, not only will their roots be improved, but their general character will be so developed, that a proper selection can be made when they are transplanted into the vineyard, so that plants of equal vigor may be planted in the same row, and every vine upon the trellis may be in an equal state of forwardness, so that each step in the system of training may be applied to all the vines at the same time. This is of the utmost importance if anything like neatness and uniformity are to be obtained in the vineyard. But it is difficult to secure this if one-year-old vines are planted, as at

that time their real vigor or weakness can not be readily determined.

To prepare the vines properly for the vineyard, they should be carefully taken up in the fall of the first season, and "heeled-in" in a cool cellar or in some dry place in the open air. They should remain in this situation until spring, when the ground has become sufficiently dry to work easily; but the earlier they can be planted, provided the ground is in suitable condition, the better. When taken out for planting, the roots should be shortened at least one third, and if very long—say two feet or more—then they may be cut back one half, as it will not only be more convenient to plant them if shortened, but the plants will be benefited.

The plants should be kept under cover while being trimmed, and the roots kept moist and out of the wind, which would soon destroy the small fibers and injure the large ones. The trenches in which the vines are to be planted should be dug before the vines are taken into the field.

Draw a line across the plot of ground to be planted, and dig out a trench as shown in Fig. 27; this is eighteen

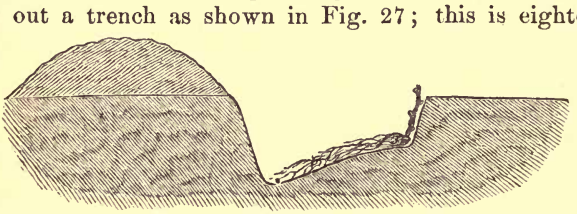

Fig. 27.

inches wide, and three deep on one side and five on the other, the bottom being slightly oval; the soil is thrown all upon one side. When a number of trenches are ready, bring out the vines and plant them in the following manner: place the vine in the trench upon the shallow side and spread out the roots toward the opposite side, then throw on soil enough to hold them in place and cover them,

then put in another vine in the same way, setting them so far apart that the roots will not crowd; twelve to eighteen inches will usually be sufficient.

One person may plant while another fills up the trench. When one trench is filled, proceed the same way with another, always being careful to have each trench dug descending the same way, so that the vines will be uniformly on either the right or left side of the trench. Then, when the vines are to be taken up in the fall, it will only be necessary to examine one vine to ascertain on which side the greater part of its roots is to be found, and the workmen can then proceed systematically, for they will know just where to dig and thus be able to avoid injuring the roots. The rows of vines should be four feet apart, which gives plenty of room to work between them during the season. When the vines are planted and the ground about them leveled off evenly, they should be cut down close to the ground, and a good strong stake six or seven feet long be put by each. That portion of the stem which is left generally has more than one bud upon it, each of which may push into growth, but usually only the upper bud will start; but if more than one should grow, the strongest only should be allowed to remain, and when this has grown a few inches it should be tied to the stake. This tying will have to be attended to at least once a week throughout a greater portion of the season. The laterals also must be pinched back as often as they start, leaving one leaf the first time, two the next, and so on; but usually two stoppings will be all that is necessary.

As the stopping or pinching off the ends of the laterals constitutes a greater part of what is termed summer pruning, and as I shall have occasion to refer to it frequently in the following pages, the reader should fully understand what is meant by *laterals*, and their mode of treatment, as it is nearly the same upon vines in all stages of their growth.

Fig. 28, E represents a portion of a vine in summer. Now, while this vine is growing it produces young branches from a bud near the axils of the leaves; that is,

Fig. 28.

from that point where the leaves join the main stem; *f* shows one of these young branches, which is called a lateral; at the point where this lateral unites with the main stem there is also a bud. Now if this lateral were broken out entirely it might injure this bud, or cause it to push into growth; or if the lateral is allowed to grow unchecked, the strength of the vine is divided into so many branches that none of them will become strong or well ripened. To prevent this, and retain as many leaves for the elaboration of the sap as is necessary for the full development of the plant, we pinch off, with the fore-finger and thumb, the end of the lateral at *a*, when it has made two or three

leaves, taking off all but one leaf. If the vine is growing rapidly, the lateral will start again and produce a young shoot from the base of this leaf, and when it has grown a few inches it should be pinched off at *b*, leaving one more leaf; *c* shows where it would be stopped the third time, should it be necessary; *d* shows a lateral as it appears when first starting. This checking the growth of the laterals not only concentrates the strength of the plant into the main cane, but it prevents the formation of a large number of small thin leaves, which are of no benefit to the plant, and are of themselves so feeble that they can not resist disease like large and strong ones, consequently they are often attacked while others escape.

There are cultivators of the vine who neither stake them or check the laterals, but allow them to grow upon the ground in disorder until they are wanted for the vineyard. This is a slovenly method at best, and vines of the first quality can not be produced in this manner, for it is not only necessary to keep them tied to stakes for the purpose of concentrating their strength, but to insure the ripening of the wood, and thereby the maturing of the roots as well. And it is a fact not to be controverted, that whenever the vine has unripened branches, there is also a corresponding number of immature roots; and these are as likely to become diseased, if not entirely destroyed, during winter, as the unripened branches. Neither will the leaves on the vines that are left trailing upon the ground be so fully developed or remain as healthy as when the vine is tied to stakes, where the air can circulate freely among them, and the direct rays of the sun reach every leaf.

When vines have grown one season in the nursery they ought to be large enough to be transplanted into the vineyard; but if not, then they should be cut down to within one or two buds of the last season's growth, and but one cane allowed to grow, as in the year before.

If at the end of the second season in the nursery the

vines have not made a growth of from five to ten feet, then we may rest assured that there is something radically wrong, either in the soil or the vines, and they should be dug up and either discarded altogether, or trimmed root and top, planted again in another situation and treated the same as one-year-old plants. But if the vines have made a vigorous growth, then they are ready for the vineyard, and in much better condition for the purpose than they will be at a future time. Vines older than three years are seldom so valuable for transplanting as those younger.

When the vines have arrived at the proper size for vineyard planting, and so soon as the leaves have fallen in the autumn, they should be carefully taken up by means of the garden fork. Raise the roots as nearly entire as possible, for if any are to be shortened or to be cut entirely away, it is better to have all before the eye so that a selection can be made, than to do it with the spade and wholly by chance. When the vines are taken up they may be immediately planted in the vineyard, provided all the circumstances connected therewith are favorable; if not, they should be put away in the ground, where they will remain safely during the winter. This latter operation is called

HEELING-IN.

The usual method of heeling-in plants, or laying in by the heel (roots) is as follows. Having selected a dry and protected situation, a trench is made in the soil a foot or more deep, and wide enough to receive the roots of the plants, and of any required length, the soil being thrown out upon one side. The plants are then set thickly together in the trench, with the tops in a sloping direction, and against the bank of soil thrown out of the trench; another trench is made parallel to the first, and the soil taken from it is thrown into the first, covering the roots, and carefully filling in all the interstices between them. Press down the

soil and smooth off the surface, so that water shall not lodge thereon. When one trench is finished, set the plants in the next, and proceed as before. When all is completed, dig a shallow trench around the whole, so as to carry off the water and keep the situation dry.

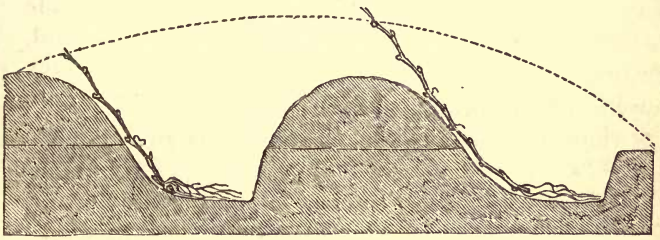

Fig. 29.

Fig. 29 shows the form of the trenches with the embankment against which the vines are placed. But the trenches are shown at a considerable distance apart; this, of course, is not as it would be in fact, because the first trench is filled up in making the second, so that the trenches are actually joined together side by side, and the vines in the two rows need not be more than a foot apart. The entire vine may be covered, if desirable, to protect the top from being injured by cold (the dotted line over both trenches in the above figure shows the form of the embankment when the whole top is covered); or the vines may be cut back before they are heeled-in, but in either case, if the whole vine is covered, it is best not to do it too early in the fall, nor let the earth remain on too long in the spring. It is also best to assort the vines before cutting off the tops, because we can better judge of the condition of the roots by the appearance of the tops than we can after they are removed. The roots may be abundant and large, yet if they are not well ripened they are of but little value, and it is not always an easy matter to determine their condition when coated with soil, as they usually are when first taken from the ground.

CHAPTER XI.

SOIL AND SITUATION.

When we take into consideration the wide extent of territory in which the grape is found growing, either in its wild or cultivated state, on both the Eastern and Western continents, we may well ponder over the oft-repeated assertion, that the vine does not succeed over the whole extent of any country, but only in certain circumscribed localities; and while we may admit its truth, we fail to comprehend the reasons why certain soils or sections of a country should be more congenial to the vine than others. Yet the fact that success does attend its cultivation in particular locations, while it entirely fails in others, is patent to every casual observer. Whether these failures are attributable to the injudicious selection of varieties, or to the mode of culture, is not always easy to determine. That the climate of both the Northern and Southern States, as well as that portion of the United States lying west of the Rocky Mountains, is congenial to the vine, is abundantly proved by the numerous varieties found growing wild over this vast region of country. No doubt there are particular varieties which are better suited to one section than to another, and that the same situation and exposure that would be most suitable for a vineyard at the South, might be the worst that could be selected for the North.

A situation protected from the cold north winds, so as to insure sufficient heat to mature the fruit, is always desirable in a cold climate; but in a hot one the heat may be so great as to exhaust the powers of the vine by a too rapid evaporation from its leaves, and it consequently fails.

Nearly all the writers on grape culture recommend the declivities of hills and mountains inclining to the south as the best exposure for a vineyard; and the next in order are the southeast, east, southwest, but never a north or a full western exposure. Virgil said, "Nor let thy vineyard bend toward the sun when setting," and these words are as applicable at the present time as they were two thousand years ago.

A full southern exposure is no doubt preferable in the Northern States, and if the land descends to the south, so much the better; but if very steep, it will cost more to prepare and keep in order than if it is level. While I admit that a side-hill is a very desirable location for a vineyard, I am quite certain that there are many situations equally good that are perfectly level or nearly so.

I have often observed that the success of a vineyardist was attributed to his soil and situation, but never to the skill of the cultivator or to the varieties grown, and this, no matter whether his soil was light or heavy, or the situation low or elevated. Still, we know that soil and situation have often much influence upon the growth and quality of the fruit; for the instances of such an effect being produced are too common in Europe, at least, to allow us to deny its truth.

In selecting a situation for a vineyard, all the surroundings should be closely observed and taken into account. If the land has no protection from the north and northwest, see what the facilities are for supplying one either by walls or a belt of trees. [If trees are to be used, evergreens are best, and often the small trees may be had in the woods near by—we now refer to the Northern States.] See that the land is sufficiently elevated, thirty to forty feet at least above streams or ponds of water; for, if near the level of small bodies of water, the situation will very likely be subject to early and late frosts.

Large bodies of water are not so injurious as small, as

they absorb heat in such quantities during summer and give it off slowly in the fall; this affects the surrounding country very materially by preventing early frosts. In spring, the water being cold, it keeps the atmosphere cool for quite a distance from the shore, and thereby prevents vegetation starting so early as it otherwise would.

This, I have always observed, was the case on Long Island; we seldom have frost as early in the fall as they do a few miles back on the mainland, and vegetation does not come forward so early in spring as to be cut off by late frosts.

When the soil is sandy or gravelly, it will require an application of some organic materials, either in the form of barnyard manure, muck, or leaf-mold. The latter two can often be readily obtained, where the former, in any considerable quantity, would be out of the question, or would be so expensive that it would very much lessen, if not entirely absorb, the profits of the vineyard. There are thousands of acres of sandy or gravelly lands in the Eastern States that would make the very best vineyards in the country, simply by applying the enriching materials that are to be found in abundance in their immediate vicinity.

Strange to say, these lands are now considered almost worthless, because barnyard or special manures (as they are called) can not be had sufficiently cheap to make them profitable for cultivation. While a sandy soil may not naturally produce the most luxuriant growth, it is certain that it produces fruit of the richest quality. Such soils are moderately favorable to the growth of the vine, are easily worked, and do not retain an excess of moisture, as they are thoroughly underdrained by nature.

Both granitic and limestone soils are excellent for the vine, and as they are usually what is termed strong soil, they need but little more than a slight change in their mechanical condition, which is readily accomplished by plowing or trenching. And here let me remark, that very often

the mechanical texture of the soil has more to do with success or failure than do the ingredients it contains.

A moderately loose and friable soil, whether it be loam, sand, gravel, or the debris of rocky hillsides, especially if of a calcareous nature, are to be chosen in preference to clay or muck. These latter may be somewhat reclaimed and made available by underdraining, trenching, etc., yet in a majority of cases they prove unsatisfactory in the end.

The soils in many portions of the Western States, and in some portions of the others that have but recently been brought under cultivation, need no addition of fertilizing materials.

New soils are to be preferred to those that have long been in cultivation; for it is extremely difficult to supply artificially to worn-out soils the lacking materials in a form so perfectly adapted to the wants of plants as that which they originally possessed. I am well aware that some agricultural chemists have endeavored to impress upon the minds of cultivators the importance of analyzing the soil, in order to ascertain what particular ingredients it may need, or what it may possess in too great an abundance to produce any particular crop or plant in perfection. And while I admit that chemists may sometimes determine when there is an excess of any particular constituent (which practical men will often do by merely looking at it), I have yet to learn that analytical chemists can tell how little of any particular ingredient is needed for any particular crop. An acre contains 43,560 square feet of surface, and if we call the soil a foot deep (and there are few plants that do not penetrate deeper than this), then there will be that number of cubic feet. A cube foot of ordinary soil will weigh from 75 to 100 pounds—we will call it 80 pounds—this gives 3,484,800 as the weight of an acre of soil one foot deep. There are circumstances of frequent occurrence when a farmer, by adding 100 pounds of some particular material to an acre of grain, will increase the

crop twenty-five per cent. And certainly it is not reasonable to suppose, nor do I think that any theorist will maintain, that it is among the possibilities of chemical science to detect even a trace of 100 pounds of a substance in 3,484,800, yet plants will detect it.

I make these remarks because I have seen men, when looking for a situation on which to plant a vineyard, who were very particular to have the soil analyzed by some celebrated chemist before they would purchase or plant. I do not wish to depreciate the science of agricultural chemistry, for it has been one of the powerful auxiliaries in the advancement of agriculture, but I would warn those who implicitly rely on all the theories advanced, that they may ask too much of it, and thereby be led astray.

PREPARING THE SOIL.

The manner of preparing the ground for a vineyard depends entirely upon the kind of soil and its natural condition. If it is heavy and compact, the first step will be to underdrain it either with stone drains or tile.

The number of drains required, and the depth to which they should be laid, will also depend somewhat upon the nature of the soil and the amount of water to be carried off. If the land has springs in it, then the drains should be placed so as to cut them off near their source and prevent, as much as possible, the excess of water from spreading.

But soils containing springs, except they be gravelly, should be avoided, as they are perhaps the most unsuitable that could be selected. There are also many soils that are called dry that should be underdrained, especially if they are inclined to heavy loam or clay, not so much to carry off the water, but to aerate the soil—that is, allow the air to penetrate and circulate through it; for air always carries with it more or less heat and moisture, and if the mechanical texture of the soil is such as to readily admit air, then

it will be more likely to be in a condition to transmit moisture rapidly, but not to hold a superabundance.

Drains are usually placed from 20 to 40 feet apart, and three to four feet deep, according to soils, situation, and the crop to be grown on the land. For vines, the drains should be placed deeper than for ordinary farm crops, else the roots will soon penetrate to and fill them. To describe the different kinds of materials used in draining lands, as well as the manner of laying, cost, etc., would occupy too much of our space, and we must refer those of our readers who wish to plant a vineyard upon soils that require draining, to those works that treat particularly on this subject.

When vines are to be planted upon steep hillsides or upon stony soils, the only thorough method of preparing the soil is by trenching. This is done by digging across the field to be planted a trench two feet wide and two feet deep—some recommend three feet or more; but if it is full two feet it will generally be deep enough, and deeper than nine out of ten do actually trench when they say three feet. After the soil has been thrown out upon one side of the trench, a parallel strip of soil, of the same width of the trench, is thrown into it, and by this means the soil is inverted, the top or surface soil being placed at the bottom, and in this way one trench is dug to fill up another, until the whole field is trenched over. The soil taken from the first trench will consequently remain on the surface above the level of the surrounding soil, and there is no soil to fill the trench last made. It is usual, on level ground, to take the soil that was dug out from the first trench and put it in the last; but to do this is often inconvenient, and I have yet to see a piece of land, of any considerable size, without a spot somewhere upon it where the soil thrown out of the first trench would not improve it by filling it up; and if the trenching is finished off upon the higher portion of the field, the trench last made may be filled up from the adjoining soil without injuring its looks. It does not mat-

ter where we begin to trench, whether in the middle or at one side of the field.

This inverting the soil, as described, is the simplest method of trenching, and is as efficient as any, provided the subsoil is not of a character so inferior that it will not be rendered suited to the growth of plants by being exposed a few months to the atmosphere. The subsoils of light sandy soils are often richer than the surface, as a great portion of the enriching materials that have been applied to the surface has been carried down by the rains to the subsoil below. But the natural richness of the subsoil when thrown upon the surface should seldom be depended upon, but manure must be added, and thoroughly incorporated with it before planting.

There are many circumstances in which the soil may be inverted to the depth of two feet with benefit—such as sandy or light loamy soils, or where manure can be liberally applied, and a year be given for the amelioration of the condition of the subsoil before planting. Where these circumstances do not exist, it is best not to throw the subsoil on top, but to mix it with the surface-soil at the time of trenching.

To do this thoroughly and conveniently, the workmen should stand in the trench, and keep an open space at the bottom on which to stand. Then, by digging down the bank and throwing it over against the opposite side, break up the lumps at the same time; the soil may not only be thoroughly pulverized, but the surface-soil and subsoil will become thoroughly intermingled.

A five-tined spading-fork is the best implement for trenching unless the soil is very hard and stony, in such cases the spade and pick must be used.

Although trenching is indispensable upon very hard and stony soils and upon steep side-hills, on level situations or those with only a moderate inclination (and they are always preferable) the plow may take the place of the

spade, and it will very much lessen the expense of preparation. If the soil is stirred to the depth of twenty inches, which it may be by using a subsoil plow, it will be as deep as is really necessary to insure a good and healthy growth of vine.

I do not believe that it is desirable to encourage the roots to penetrate to a great depth, especially in a northern climate, for when the roots penetrate deeply they do not come into full action until late in the season, and they also continue to act late in the autumn, thus preventing the early ripening of the wood.

If the soil is not naturally rich, spread the manure upon the surface before plowing, then turn it under with the surface plow, and let the subsoil plow follow in the same furrow, breaking up the subsoil. After the ground has been all plowed over in this way, then cross-plow it in the same manner; this will insure a thorough breaking up of the soil and mixing of the manure with it. When the land has been both plowed and cross-plowed, if it is then gone over with the cultivator it will still benefit it very much, as it will break to pieces the lumps which will be left unbroken after even the most thorough plowing.

We should always endeavor to make thorough work in the preparation of the soil before planting the vine, for it is not an ordinary crop that we are to plant, nor one that necessitates a seed-time to each harvest, but it is one that requires but one planting in a lifetime, yet it will reward us with many harvests.

There are very few soils that a person of good judgment will select that will need any further preparation than that which can be done with the plow, with the addition, perhaps, of underdraining. Manures, of course, must be applied where the soil is not rich enough without them.

MANURES AND THEIR APPLICATION.

The quantity of manure required by an acre, to fit it to produce a strong and healthy growth of vine, can not be known until the fact has been ascertained by actual experiment upon each individual piece of land, and the vineyardist only can be the judge in the matter. But it is always best to be on the safe side and put on enough, because the vine will soon exhaust the surplus if any; while if too little is given, a complete failure may be the result. As vines seldom starve to death the first season, although their growth may be small and weak, if supplied with a sufficient quantity of the proper fertilizers the second year, they may not only live but finally become strong and productive, at a loss to the cultivator of a year's growth, the penalty for his ignorance or negligence.

In all sandy, gravelly, and light-loam soils there is usually a want of organic materials, and that want must be supplied by applying muck, leaves, leaf-mold from the woods, sods, or barnyard manure, or it may be supplied by growing clover or some other similar crop and turning it under while green. When muck or leaves are used, it is best to compost them with barnyard manure. This may be done by spreading the materials over the barnyard a foot deep, and then spread the manure over it and let the cattle tread it in; and when the manure has accumulated to the depth of six inches, spread on another foot, and so until it is three or four feet deep; then it should all be forked over and mixed together. If the whole is under cover it is better; but it is not very essential, unless manure is very scarce and valuable. The muck absorbs all the liquid portions of the manure and prevents waste, and a compost of three-fourths muck or of the other materials named and one-fourth barnyard manure is more valuable for a light soil than if the whole amount were barnyard manure.

When it is not convenient to make the compost heap in the barnyard it may be made anywhere in the fields, by first laying down a foot in depth of any of those materials and then drawing out the manure and spreading it over the surface, putting on alternate layers until a sufficient quantity is obtained. The compost heap should be kept level on the top or a little inclined toward the center, so that it shall receive the water that falls upon it. This will cause it to decompose more rapidly than if the water did not penetrate it.

The compost should be frequently turned over, so that it may become fine before it is wanted for use. It will seldom be fit to use in less than six months, and it is better to let it remain one year. Ashes may be applied to the compost at any time with benefit; also ground bones, charcoal, horn shavings, offal from the butcher's, refuse from rope-walks, woolen and cotton factories, etc.; in short, almost any such materials may be mixed in; they are all good, but not positively necessary, nor worth while spending any great amount of money or time to obtain. Lime and ashes are both very beneficial to light soils, but they may be applied alone, and upon the surface of the soil after the vines are planted. Lime especially should be applied in this manner, as it descends rapidly into the soil and needs no mixing with it; besides, when applied upon the surface it will often assist in the destruction of the larvæ of insects, in the decomposition of vegetable matter, etc. Shell lime is considered the best, but the difference is so slight that it will not pay to transport it any great distance if stone lime can be had near at hand.

The compost should be spread upon the soil and plowed in as has been described, before the vines are planted.

The quantity may vary from fifty to five hundred two-horse wagon-loads per acre, but it is not judicious to put on too much at first, as it will cause a rampant growth;

it is not desirable to produce such, as it will be troublesome to keep it in check when we come to train the vine.

It is better to apply sufficient to give the vines a good start and apply more in after-years as needed.

There are sections of the country where there are sandy and gravelly soils that are well suited for vineyards, but barnyard manure can not be obtained. If either muck, mud from streams, or leaf-mold can be had, they may be used without the barnyard manure, but they should be placed in heaps where they can be forked over occasionally so that they will become sweetened, as it is termed, before using; and it is well to mix a quantity of lime or ashes with them, to assist the decomposition. A bushel of salt to every ten or fifteen loads may also be added with benefit.

Soils that are more compact, such as are called heavy loam, or approaching a clay, do not need so much of the organic materials as those called light soils, as most of them contain more or less of them; but they require thorough pulverizing; after which, if a good dressing of well-rotted barnyard manure is added, little more is needed before planting the vine. Any soil that will produce a first-rate crop of corn or potatoes is rich enough for vines. A few shovelfuls of manure, or two or three quarts of bone-dust may be mixed with the soil when the vine is planted, especially if the vine is not one of the strong growing varieties. And it may not be out of place to mention here that there is a great difference in the growth of varieties, and the soil should be prepared with reference to this fact. Some kinds would entirely fail upon soils which would be rich enough for others. If we should make the soil rich enough to produce a strong growth on a feeble growing variety, and then plant it with a strong growing one, there would not only be a waste of materials and labor, but the rampant growth produced would be an abomination to the vineyardist when he came to train his vines; for he not only endeavors to train them, but to control their growth.

SPECIAL MANURES.

There are many kinds of manures known as "special," some of which are, no doubt, valuable; but where those materials which have been mentioned can be obtained, there will be no necessity of looking after the specially concentrated manures. Guano, poudrette, superphosphate of lime, etc., may occasionally be used with benefit to give the vine a start when first planted, but it is doubtful whether it would be judicious or economical to depend entirely upon any of them to carry it through a succession of years. I have found fine ground bones to be a safe and not very expensive stimulant for the vine. I use two to four quarts to each vine when planting, mixing it with the soil immediately about the roots.

After a vineyard is planted, manuring must not be neglected, for the vine needs not only to be supplied with food at the start, but it will want feeding continually, if it continues to grow and bear fruit. How often it will need a supply the vineyardist must be the judge. All that is required is to keep up a healthy growth. Too much manure may increase the size of the fruit, but it will injure its quality. The manure may always be applied upon the surface and worked in with the cultivator or hoe, but the plow should never be admitted into a vineyard, as it will cause more injury than benefit.

Frequent and regular top-dressings of manure are better than large applications at long intervals. Rank unfermented manures should not be used for this purpose, as they will often injure the flavor of the fruit; besides, they will more or less affect the health of the leaves.

Upon very open and porous soils a mulching of leaves, straw, tan-bark, or similar materials will be very beneficial, but upon more compact soils it is better to keep the surface of the soil open by frequently stirring it with the hoe

or cultivator, so that it will the more readily admit the air, and with it heat and moisture. When such soils become surcharged with water, as they frequently do during long rains, they will give off much of the surplus moisture if the surface is kept open and uncovered; but when they are covered with a mulch, they retain too much near the surface, and the soil will become soured and the surface roots be destroyed in consequence. With all the care that may be bestowed upon the vine in regard to soils, manures, etc., much will still depend upon the system of pruning and training adopted.

CHAPTER XII.

STEM APPENDAGES.

THERE are various appendages to the stem of the vine, such as spines, hairs, etc., which are of service to the botanist, as they assist him in determining the different species, varieties, etc.; but those that are of the most interest to the practical vineyardist are the laterals, leaves, tendrils, and buds.

The mode of treating laterals has been given in a preceding chapter, in which it was shown how they may become injurious or beneficial to the vine, according to the will of the vineyardist. Leaves are the most conspicuous appendage of the vine, and they are of the greatest importance, as it can not exist without them. They are sometimes called the lungs of plants, and many beautiful theories have been brought forward in accordance with the similitude. Their chief office appears to be to assimilate materials which are taken up by the roots, and to do this it is necessary that their surface should be exposed to light. The greater surface of leaves that a vine exposes to the sun, the greater power will it have to take up liquids from the soil, and with them those constituents which go to make up the whole structure of the vine.

This being the fact, it can readily be seen how, by diminishing the number of leaves, we check growth, or *vice versa*. But it should be borne in mind that simply taking off a portion of leaves will not always actually diminish the strength of the vine; for instance, if they are much crowded, one portion may shade the other, and all may be small, feeble, and of little use. If a part of these are removed,

those remaining expand, and one leaf may become of more importance to the vine than a dozen when crowded.

This is why we pinch off, thin out, etc.; for the results of these operations show that, when under cultivation, vines will produce a larger number of leaves than are necessary to secure the proper development and health of the plant.

Although the general appearance and structure of vine leaves are very similar, yet there is a great difference in the relative power of leaves of different varieties to withstand the various changes of climate, disease, etc.; and it is of the utmost importance that their full development should be attained in all cases, so that they shall not be affected by the ordinary changes of the temperature during the period of growth.

FORMS OF LEAVES.

To mention even a hundredth part of the various forms of vine leaves would occupy too much of our space. But I have given the following illustrations for the purpose of showing the different characteristics of the leaves of some of the different species, and at the same time convey a better idea of the meaning of some of the terms commonly employed in describing the leaves of the different kinds, than could be done without engravings.

The leaves are necessarily shown much smaller than the natural size, but in doing so I have endeavored to preserve their most prominent features. In making the selections for the engravings from my sketch-book, I intended merely to choose those which were quite distinct; but since they were engraved I have found that, although inadvertently, I have selected those that are natives of as widely separated portions of the globe as completely as I could have possibly wished had I aimed at doing so. The leaf has two distinct portions—the expanded part, or *blade*, and the

leaf-stalk, or *petiole*. The petiole is attached to the *base* of the blade, and the opposite point is the apex. The general outline of grape leaves is more or less heart-shaped.

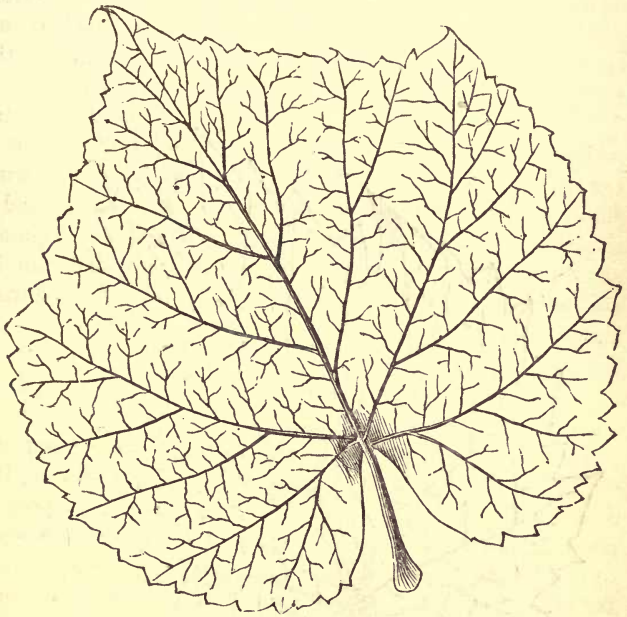

Fig. 30.—The Oporto.

The Oporto (Fig. 30) is round, heart-shaped; the Nebraska (Fig. 31), acuminate or pointed-heart-shaped; while the Scuppernong (Fig. 32) is scarcely heart-shaped at all, but nearly orbicular. The edges of the leaves are variously notched, and these markings, as well as the general shape, are of importance in distinguishing species and varieties. It will be seen, by comparing the different figures of grape leaves, that the notches differ not only in shape but in depth. These divisions upon the margin when small, and shaped like those in the leaf of the Oporto, are called teeth, and such leaves are said to be dentated or toothed; here

the leaf is finely dentate, while in the Scuppernong (Fig. 32) they are coarsely dentate, and in the Yeddo (Fig. 33) crenate or scolloped-toothed.

Fig. 31.—The Nebraska.

The leaf of the Nebraska grape (Fig. 31) is cut-toothed, the divisions being irregular and sharp. When the divisions are larger they are called lobes. In the Texas Post Oak grape leaf (Fig. 34) 1, 2, 3, 4, 5 are lobes, and the leaf is said to be five-lobed. The Yeddo leaf is three-lobed, and the Nebraska and Oporto are obscurely three-lobed. In

the Post Oak grape leaf the lobes 1 and 5 overlap the leaf-stalk, and these portions which do this are called *alae*, or wings; some of the other lobes in this leaf overlap, but no

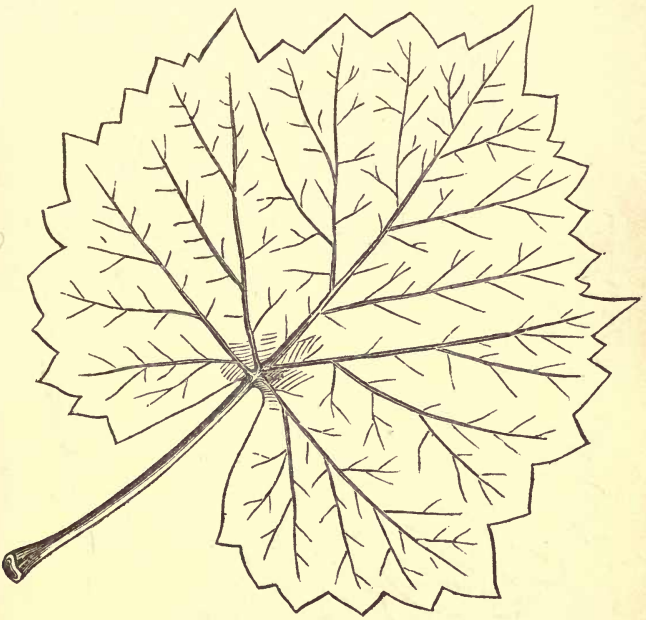

Fig. 32.—The Scuppernong

distinctive name is applied to them. The spaces between the lobes, as well as the depression at the base of the leaf where the petiole is attached, are called *sinuses*, and the shape and depth of these afford distinguishing characters. These are the principal terms used in describing the shape of grape leaves, and the strikingly different forms can be described so that they may be recognized; but it is often the case that the difference in foliage in distinct varieties is so slight that, although it is readily perceived by a practical eye, it is not possible to express these distinctions in words.

There are also many other marks that aid us in distinguishing the different varieties—perhaps the most variable of these is color, as the leaves of scarcely any two varieties

Fig. 33.—The Yeddo.

possess the same shade of green, although it is the predominant color in all.

The Scuppernong leaf is a light green, and smooth on both sides, and shining on the upper, while the Post Oak grape leaf is a dark, dull green on the upper side, and rusty-woolly on the under side. The petiole and veins of some leaves are red, others dark brown, and in others the red color pervades, more or less, the whole leaf. When the leaves are smooth they are called *glabrous*, and if not,

they are called *pubescent*—woolly, or hairy, according to the degree of roughness. When the leaves are merely smooth, they are called glabrous, but if they have a polished

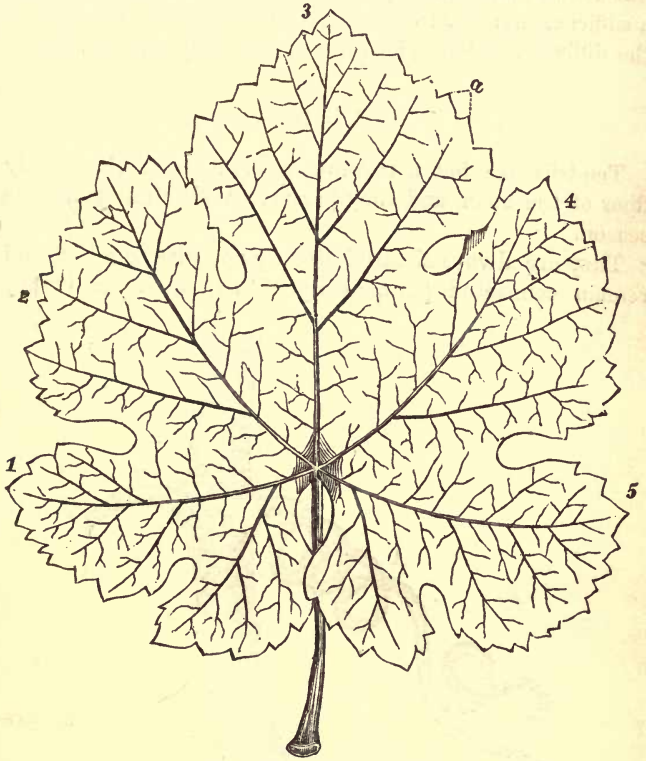

Fig. 84.—The Post Oak.

surface, then they are called shining. When the leaves are covered with a whitish bloom, or waxy substance that readily rubs off, they are called glaucous.

There is also a great difference in the texture of leaves, some are very thick and tough, while others are brittle, But the thinness or thickness of the leaf does not indicate

the strength, for some that are quite thin are very strong and enduring.

Other characteristics of vine leaves might be mentioned, but enough have already been given to show that there is a sufficient number to enable a close observer to distinguish the different varieties, however closely they may be related.

TENDRILS.

Tendrils are but a tortuous elongation of the woody fiber of the stem, and they preserve their vitality but one season.

They are always situated directly opposite to a leaf, and remain connected permanently to the stem until they

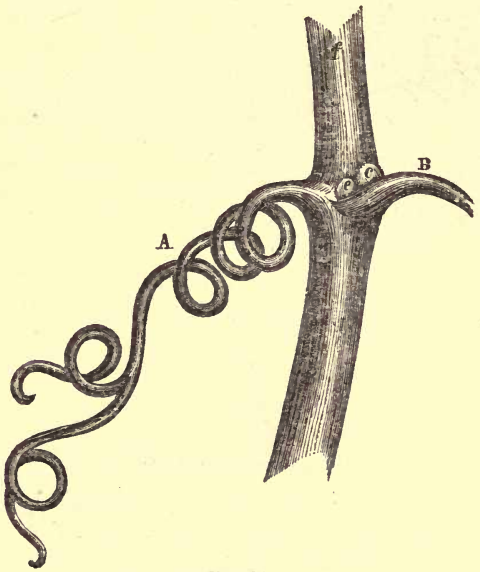

Fig. 35.

decay; while the leaf is united only temporarily, and drops off at the end of the season. In the wild vine the tendril

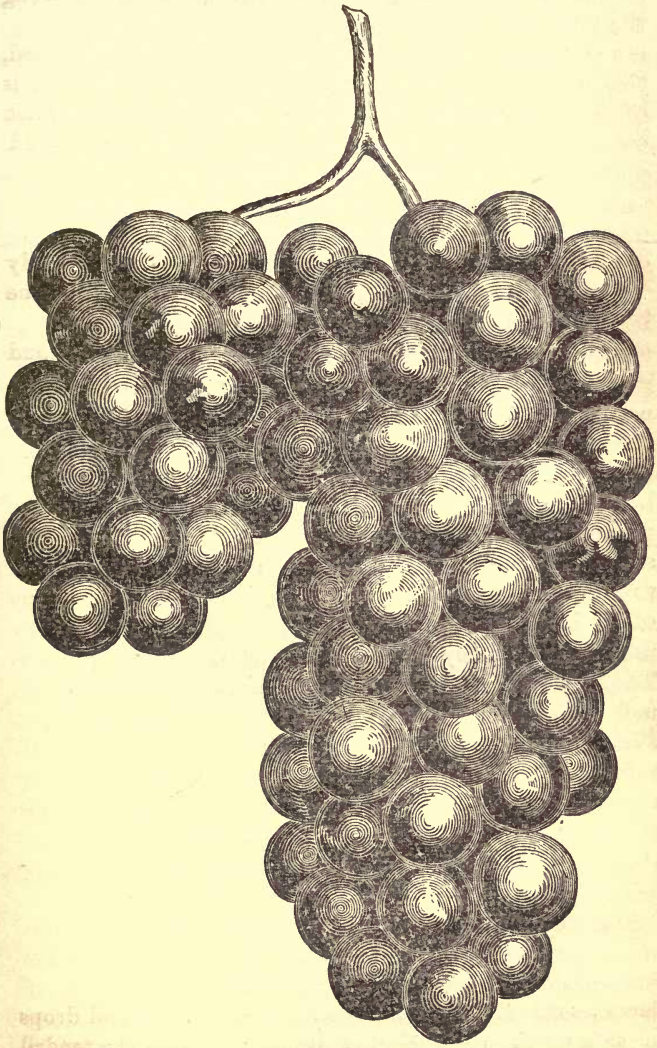

Fig. 86.

serves an important purpose in assisting it to climb; in the cultivated vine, it being artificially supported, tendrils are no longer needed, and may be cut off while young, as they are not only useless, but will, if allowed to remain, often cause the vine to become entangled, and produce confusion where order is necessary. Fig. 35—*f* shows a portion of a vine with tendril (A) attached, the end of the tendril in two divisions, one considerably shorter than the other; both of these possess much interest when, instead of being tendrils, they are bunches of fruit.

The first three or four tendrils produced in spring upon bearing vines are but the peduncles or flower-stalks of the thyrse of flowers, which eventually becomes a bunch of grapes. But if the elements requisite to support the flowers and fruit are not supplied, or by accident the proper amount of light and heat is excluded, then these peduncles will become tendrils. Therefore a tendril may be said to be a barren peduncle, and a bunch of fruit a productive tendril, for they may become either under favorable circumstances. The divisions of the tendril referred to above show a peculiar characteristic in the formation of the bunch of fruit, which is seen in most of our native as well as in many of the European varieties of grapes. The longer division becomes the main body of the bunch, and the shorter becomes what is termed the shoulder. Fig. 36 shows a bunch of grapes as produced from a divided productive tendril. This form of bunch might be appropriately called the natural form, and certainly it seems to carry with it more of the general idea of a bunch of grapes than many of the other forms which are occasionally seen.

Sometimes a bunch is divided into several small clusters which partly or entirely surround the main body; when this occurs they are called clustered bunches instead of shouldered. But as the bunches of fruit are more or less variable in the same kind of grape, it is not expected, in

describing a variety, that more than their general character can be given.

BUDS.

Buds are embryo plants, for they contain all the elements necessary to insure or secure, when removed from the parent, a distinctive, individual existence. They contain the rudiments of leaves and stem in a miniature form, and growth is but the development of these individual parts.

The buds of the vine are situated at the axils of the leaves only, and are never found upon any other part of the stem. They are naturally single—that is, produce but one shoot; but vines when under cultivation often show a disposition to produce a number of shoots from a bud, or, in other words, the buds divide indefinitely, and each division is capable of producing a distinct cane. Fig. 35—*e* and *c* show a double bud; such examples are often seen upon trained vines, and nearly every bud upon vines that have been checked during growth will show the double bud, both of which will often produce a shoot, but seldom of uniform strength. If a shoot that has started from a bud is broken off, others will immediately start from near its base. These are said to grow from accessory buds. They are sometimes incorrectly called adventitious; but adventitious buds do not exist upon the stem of the vine as they do upon most other woody plants.

The word adventitious is from adventive, implying accidental, and not necessarily pre-existing in form; and as I am not aware of any instances where buds have been produced by art or nature upon the stem of the vine, except at the point where buds originally existed, we may conclude that they are accessory buds. Buds will sometimes be produced from the lateral roots of the vine at the point of separation, especially if they are of considerable size; these are, strictly speaking, adventitious. Although several shoots may be forced to grow from what is apparently

a single bud, yet it is seldom judicious to do so; for if the bud produces but one shoot, it will be much more vigorous than if the strength of the plant is divided among several. It is a matter of considerable moment to the vineyardist that all the main buds be fully developed, and especially those that are required for producing fruit and bearing canes, as it is only from such buds that the largest and best fruit is produced. Keeping this fact in view, every precaution should be taken to preserve the vitality as well as the full development of the buds.

Nature has provided a protection to the buds by cover ing them with bud-scales, which ordinarily serves to protect them against the sudden changes of the atmosphere while they are dormant; but in some sections of the country this protection is insufficient, and their vitality is either entirely destroyed or very much injured. In such localities an artificial protection must be furnished. The method of applying such a protection will be given in a future chapter.

CHAPTER XIII.

PLANTING THE VINE.

THERE seems to be as great a diversity of opinion among vineyardists in regard to the best time to plant as there is upon the various details connected with planting. My own rule is to plant vines in the fall whenever circumstances will permit me to do so; but if it is not convenient to plant at that time, then I do the next best thing—that is, plant them so soon in the spring as the soil is in a condition to permit of it. I prefer planting in the fall, because the soil becomes settled about their roots, and all wounds made upon them in the process of transplanting will, in a great measure, become healed, and very often new roots will issue before the ground would permit of the vines being planted in the spring. Thus they become all ready to commence growing as soon as the frost is out of the ground.

The buds will commence swelling at the first approach of warm weather, and they are then very brittle and liable to be broken off.

I think, as a general thing, vines planted in the fall will make at least one third more growth the first season than when planted in spring. In very cold localities, or in soils that are naturally tenacious and heavy, spring planting is perhaps preferable to fall. But it should be a maxim with the vineyardist: never put off until another season that which may be safely done in the present.

The condition of the soil must in part govern us in this operation, for it will not do to plant the vines when the soil is soaked with water, for in that condition it can not

be readily divided so as to be made to intermingle with the roots. Nor will it do to plant when the soil is parched and dry; but it should be in that moist and friable condition which allows it to be easily worked.

ROOT PRUNING.

However carefully vines are taken up from the nursery, the ends of a greater portion of the roots will be broken off. These should be cut smoothly before planting. It is also beneficial to shorten the roots considerably, especially if they are long and destitute of branching fibers. Two feet is long enough to leave any root upon a two or three year-old vine; longer ones should be cut off, not only to render them more convenient for planting, but to incite the main roots to throw out new ones from their ends as well as from their sides. The soil will thereby become filled with feeding roots instead of a few long naked ones, that have no power of absorbing food except through the small fibers which exist only at their extreme ends. The soil within the radius occupied by these long roots is useless so far as furnishing nutriment is concerned, because they are not capable of absorbing it. It will often be necessary to shorten the roots to less than two feet, and it is best to cut off a portion of the ends, no matter what their length may be. For it is not the length or number of roots that determines the quality of the vine, but their condition. If long, soft, spongy, and unripened wood and roots are left upon the vine, they are of but little benefit to it at best, and they will often die, and in their decay communicate disease to the other and more healthy portions of the plant. This is particularly the case with layers—their roots being produced late in the season, they are seldom ripened to their full length; hence the necessity for severely shortening their roots. And here, I believe, is the chief cause of so much discussion upon the value of layered plants. Those

who obtain properly grown layers and cut back the roots to at least one half their length before planting, pronounce them to be equal to plants grown in any other way. But those who have pursued the opposite, and planted them with their roots entire, fail to produce healthy or vigorous plants, and therefore condemn them.

Vines will sometimes have so great a number of roots, that when transplanted the number of buds left upon the stem is insufficient to call them into action, and they perish in consequence; for roots will not remain entirely inactive for any considerable time during the growing season without suffering. If the roots are so crowded that they can not be distinctly separated and a clear space be allowed for each when placed in the ground, then a portion should be entirely removed.

If the texture of the soil is such as to make it congenial to the growth of the roots and permit them to permeate it without hindrance, their course will be more inclined to the horizontal than the perpendicular, and certainly the former position is more desirable than the latter. For when the roots spread out horizontally, they remain near enough to the surface to receive the full benefit of all top-dressings of manure which may be applied to the vineyard. They are also more accessible to heat, air, and moisture, than when they penetrate deeply. And while it is desirable to encourage the spreading of the roots in every direction, so as to occupy every portion of the soil and have them near enough to the surface to receive all the benefit possible from such a position, yet we should not place them too near the surface at the time of planting, nor endeavor to keep them there. For unless the roots are covered deep enough to prevent their being affected by sudden atmospheric changes, the vine will surely suffer. Roots that are near the surface appear to be more sensitive than those which are deeper, and they are the first to start in the spring, and the first to be checked by cold in the autumn,

or by long drouths in summer. The depth to which roots should be covered depends somewhat upon circumstances. In light soils they should be covered deeper than upon heavy, because the air has a more ready access to a porous soil than it has in one that is tenacious; and while it is necessary that air should reach the roots, it is not judicious to allow it to penetrate too freely, because roots require a partially confined atmosphere, and not one that has any apparent circulation. There is one class of cultivators who advocate deep planting, and they place the roots from twelve to twenty-four inches deep; another class follow the other extreme, and but little more than cover the roots with earth, and then depend upon mulching for the requisite protection; and although both of these extremists offer many plausible arguments in support of their different theories, yet a middle course, I am confident, is the safest and best.

HOW TO PLANT.

When a number of vines are to be planted, it is best to dig the holes before the vines are taken into the field, and when they are taken from the place where they have been heeled-in, their roots should be kept in a box or basket filled with damp moss, or protected in some such manner from the air and sun. The vines should also be pruned before they are taken into the field. Prune the roots, as has already been directed, and cut off the stem to about eighteen inches. The holes to receive the vines should be dug in a circular form, and from six to ten inches deep upon the outside, and four to six inches in the center; then set a good strong stake in the center of the hole, for unless the stake is placed in position before the vine is planted, there is great danger of injuring some of the roots of the vine in driving it down by its side after it is in position. Now set the vine in the center of the hole close by the stake, spread out the roots in every direction, and throw on a lit-

tle soil as you proceed, to hold them in position. When all the roots are properly distributed, then fill up the holes, pressing down the soil with the foot—the weight of a man will not be too much pressure to give the soil over the roots. It requires two men to work to advantage in planting, one to place the vine in position and spread out the root, and another to put in the earth. Fig. 37 shows the

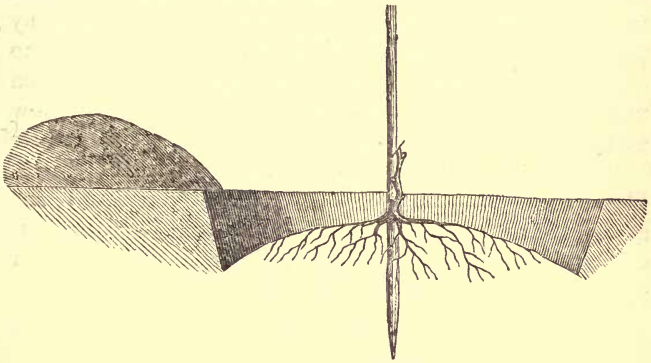

Fig. 37.

form of the hole, with the stake and vine in position, ready to be filled up. The roots should always descend a little from the stem to their farthest point, and in pressing down the soil upon them, it should be given the same pressure, as near as may be, along their whole length. If the vines are planted in the fall, then a small mound of earth should be made around the stem, so as to protect two or three buds above those that would be covered if the ground were made level. But when the vines are planted in the spring, the hole need not be filled quite full, but a shallow basin may be left about the stem so that the rains shall more readily reach the roots. This basin around the vine may be filled when the vine gets well started into growth. When the buds begin to push into growth, select the strongest and rub the others off; a bud near the ground is preferable to one that is a foot above, and this is one

reason why the vines should be cut off quite short when planted, as it makes the lower buds more sure to push. After the one bud or shoot has been selected, the old stem above it may be cut off to within two inches of the young shoot. As the young cane grows, keep it tied to the stake, but do not tie it so tightly as to interfere with its expansion as it grows. Keep the laterals stopped according to the directions already given. Stir the soil about the plants, the oftener the better, and keep down all weeds.

Bass is an excellent material for tying the vines, as it is not liable to injure the tender shoots; besides, it usually costs less than common twine.

When any particular vine, or a number of them, do not grow as rapidly as desired, they should receive some extra stimulant, either liquid manure from the barnyard, or a solution of some of the concentrated manures in water, giving enough to completely saturate the soil to their roots. When it is not convenient to apply stimulants in a liquid form, a barrow load of compost may be spread upon the surface about the vine. We should endeavor to produce a uniform growth, so that all the vines in each row, at least, shall be as nearly of the same size as possible.

The vines, at the end of the first season, will usually be large enough to be pruned for training, but many of the more feeble growing varieties will require another year, and they should be cut back in the fall or winter to two or three buds, only one of which should be allowed to grow, as in the first year.

Layering is another method of assisting feeble growing varieties, and it may always be practiced with the best results. The operation is performed the same as that for layering grafted vines, described on page 70. The most feeble growers will generally make a strong growth the season after they are layered, and while such a practice is very beneficial to the feeble growing varieties, it is entirely unnecessary with the more vigorous vines, as they will

usually grow as strong as it is desirable, and still have them in a condition easily controlled when we come to train them.

There are some propagators who strongly advocate the layering the vines for one or two years after they are planted in the vineyard. This may arise from the fact that they produce such poor plants that their customers would be very much dissatisfied with the results of their purchase if some such course were not pursued; or, it may be, that they imagine that the whole object of planting is to obtain a large growth of wood. This certainly would be of great importance to those who grow vines mainly for propagation; but the vineyardist has a higher aim, as fruit is the object and not wood. This practice of layering the vine to promote growth is an old European method, which is practiced upon old worn-out soils, where there is need of resorting to every plan that will afford any support to the vine. With our strong growing varieties and rich soils, the practice of layering all kinds is certainly not advisable.

CHAPTER XIV.

GRAPE TRELLISES.

THE usual manner of making grape trellises with wires running horizontally is not only very objectionable, especially when the vines are trained with horizontal arms, but it is a much more expensive method than the one shown in Fig. 38, consisting of two horizontal bars and perpendicular wires. Everybody who has made trellises in the

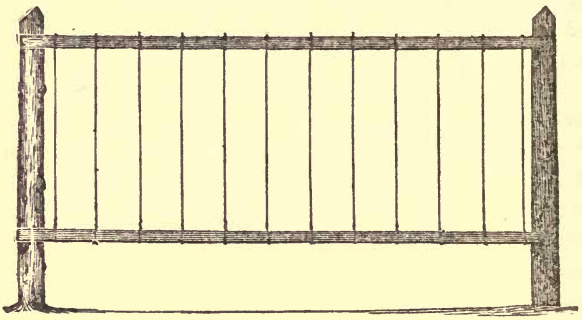

Fig. 38.

ordinary manner is aware of the difficulty of keeping the wires straight, even if the posts to which they are fastened are not more than eight feet apart, as the wires will contract and expand at every change of temperature, being loose on hot days and tight on cold ones. Besides, much larger wires must be used, if put on horizontally, to support the fruit and the vine. But the most serious objection that I have found is, that the wires, unless very near together, are not where they are most needed when the young bearing shoots first start, for they must be tied to something to support them when only a few inches long, or they are very liable to be broken off by heavy driving rains. If the wires are eight inches apart (which is nearer

than the usual custom to place them), the young shoot must be at least twelve to fifteen inches long before the strength of the vine will admit of its being tied to the horizontal wire; besides, when tied, the strings will allow the shoot to slip lengthwise of the wire, and often it will crowd or become entangled with its neighbors. To tie the vine very tight to the wire would cause it to become girdled as it expanded in growth.

The above are but a few of the difficulties which I have had to overcome in using the common grape trellis with horizontal wires or bars, and to avoid these difficulties I have adopted upon my own grounds a trellis with horizontal bars and perpendicular wires, shown in the preceding illustration. It is built in the following manner: select posts of good, hard, durable wood, of from four to six inches in diameter and six and a half feet long; set them in the ground two and a half feet deep, and in a line with the vines, and eight feet apart—that is, if the vines are that distance apart; a post should be placed between each two vines at equal distance from each. When the posts are set, nail on strips two and a half to three inches wide and one inch thick, one strip or bar being placed one foot from the ground, and the other at the top of the posts. Then take No. 16 galvanized iron wire and put it on perpendicularly, twisting it around the lower and upper bar, each wire being placed just where the upright bearing shoots are to grow. It is well not to put on the wires until the vines are ready for training, and then lay down the arms by the side of the lower bar, and make a mark on it where each wire is to be put, before fastening the arm; then remove the arms to one side while putting on the wire. If a wire should not be in the exact place where it is wanted, it can be easily moved to the right or left, provided it is only twisted around the bars. The distance between these upright wires will differ according to the variety of vine, as the distance between the buds varies

very materially in different varieties, but usually from eight to twelve inches will be the proper distance, sometimes wiring at every bud, and with others only at every alternate one.

It will readily be seen that in this mode of making a trellis, when the young shoots start they can be tied at any time when necessary; and there is no need, nor is it judicious, to tie them tight to the wire; they should be left at least one inch from it, the two shoots being tied to the one wire. The cost of wire is less than when large horizontal wires are used. The arms should be fastened to the lower bar, either by strips of leather tacked on or by tarred twine tied around the arm and lower bar. It is impossible for me to give anything like a correct estimate of the cost of building a grape trellis after this plan, because the different materials used in its construction are very variable in price; besides, that which would constitute the greater part of the expense in one section of the country might be the least of it in another. Galvanized iron wire should always be used in preference to any other. It costs from three to five cents per pound more than the common annealed wire, but its lasting qualities are so much greater that it fully compensates for the additional expense.

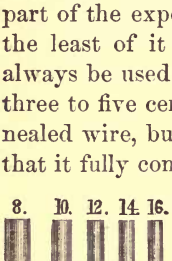

Fig. 39.

Fig. 39 shows the relative sizes of such as are commonly used for trellises. Nos. 14 and 16 are large enough for the perpendicular wires on such trellises as I have described; 8 and 10 are the sizes used when put on horizontally. The number of pounds of wire required for a given length of trellis may be readily ascertained by calculating the number of feet required, and then dividing the amount by the number of feet in a pound, which is as follows:

No. 8. 13 feet to the pound.
No. 10. 20 " " " "
No. 12. 33 " " " "
No. 14. 54 feet to the pound.
No. 16. 102 " " " "

CHAPTER XV.

TIME TO PRUNE VINES.

The time for pruning vines will vary with the locality in which they are grown; but, as a general rule, it may be commenced as soon as the vine has shed its leaves in the autumn; and if the wood is to be used for propagation, it is certainly better if taken from the vines before it has been severely frozen. But in pruning in the autumn or winter, the vines should not be cut back to the bud or buds that are wanted for fruit, but leave one or two extra ones above them, and then go over the vines a few weeks before they start in the spring, and cut off these extra buds. This second pruning I usually do the last of February or the first of March, always pruning before the cold weather is entirely past; for if delayed until the sap begins to flow rapidly, it will issue from the wounds in such excessive quantities as to materially injure the vine. If the vines are pruned in the autumn down to the buds which are wanted for producing fruiting canes, the uppermost buds are very likely to be winter killed. Even where the winters are not severe, it is best to leave one extra bud, because the sap will usually recede from the part which has been cut, and the end will become somewhat dried, if not injured by cold.

Where vines are laid down and protected in winter, then the pruning may be completed at once, as no second pruning will be necessary, the covering given to the vines protecting them both from the effects of the cold and dryness. Some vineyardists do not prune at all until the latter part of winter or early spring, in which case no extra buds

should be left. There is a theory in regard to time of pruning which is of very ancient date, and as it has been and is still taken as a partial guide by many cultivators in pruning not only the vine, but other fruit-bearing plants, I will give the main points of it as briefly as possible. According to this theory, when cold weather first checks the growth of the vine, it does not entirely stop the absorption of food by the roots; consequently the vine becomes surcharged with sap, the liquid portions of which are partially given off by evaporation through the bark and buds, and the more solid portions are deposited throughout the entire length of the vine, so that each bud is equally supplied with its quota of food with which to commence vegetation anew in the spring. Now suppose a portion of the vine is cut away early in the fall, it is evident that that which remains has the whole root for its support, and it may receive all the strength that would have been diffused throughout the unpruned vine. The few remaining buds will of course put forth in spring much more vigorously, and send out fruit-bearing wood in greater perfection than it is possible for an unpruned vine to do.

I doubt the truth of this theory; but, according to it, the rule for pruning would be: if the vine is weak, prune early—that is, so soon as it sheds its leaves; but if it is a vigorous grower and a shy bearer, then prune late. That pruning the vine at different periods produces a different result is no doubt true, but it is difficult to determine just how much difference it makes, because no two vines in the vineyard will grow two successive seasons with exactly the same vigor, even if they are pruned at the same time both years.

PRUNING AND TRAINING.

Having endeavored in the preceding pages to give the necessary details for laying the foundation of successful grape culture, we will now consider the best method of

building up and completing the structure. No matter how thoroughly this foundation has been laid, or how congenial are all the surroundings, unless we practice a system of pruning and training that harmonizes with the known laws that govern the growth of the vine, all the care that has been or may be bestowed upon it will not bring bountiful crops, or insure us against a partial if not a total failure. The success of grape culture in this country depends almost entirely upon a general diffusion of practical information relative to pruning and training.

There is certainly much depending upon the adaptation of varieties to different localities as well as the mode of culture adopted, but these points seem to be better understood than pruning and training, as information relative thereto is easily conveyed through the ordinary mediums for reaching the public. The interest manifested at the present time in grape culture owes its origin in a great measure to the fact that with the introduction of new native varieties of superior merit, the attempt to cultivate foreign varieties in the open air has been discontinued, thereby removing one great cause of failure. Many persons who experienced failure from this cause pronounce all attempts at grape culture in this country to be useless. Another class of cultivators, having escaped the foreign grape fever, have caught the native one, and judging from observation only, condemn not only the foreign varieties, but all the modes and systems ever adopted for their cultivation; some of these cultivators are now groping their way in the dark, following no system, because they have been unable to find one in which there is nothing foreign. I have digressed from the more practical part of my subject to show how readily some will let their prejudices lead them from one fatal extreme to another.

While I rejoice that the time has come when no intelligent man in the Northern States would think of planting a vineyard with foreign varieties, still I am not ready to

admit that all the experience of the vineyardists of Europe is of no practical value to us.

The same laws that govern the growth of the foreign vine control that of ours, and I have no reason to doubt that some of the best systems of training that have been so long successfully employed in Europe would, with slight modification, be almost as successful here. I know that it has been repeatedly asserted that the American species and varieties of the grape are much stronger and of coarser growth than the foreign ones, consequently they can not be so readily brought under control, or be kept within similar limits, without destroying their usefulness. But my own experience and observation lead me to think that so far as regards growth this is an error, and that naturally the foreign are on the whole as vigorous growers as are our native varieties. When grown under glass they appear to be more so, and whenever they are grown in a favorable situation in the open air, they are not only strong, but often rampant growers. We can not arrive at a correct estimate of what their natural growth would be under favorable circumstances by what we see in the old vineyards of Europe, where the soil has been under cultivation for centuries, or by observing them in our own country, where they seldom pass the first season without being attacked by disease.

It is not necessary for us to follow strictly any of the European systems of culture or training, but by gathering from foreign experience that which is of value to us, and sifting out principles from prejudices, we may arrive at facts which are very important.

It is not necessary, nor would it be judicious for us to undertake to dwarf the native vine to that extreme to which it is carried in some parts of Europe, but we should stop midway between it and the wild vines of our forests. I know there are some who are continually pointing to the wild vine as an example of what the cultivated vine should

be, and they tell us that these vines bear fruit and are free from disease. This we are ever ready to admit; but we are not cultivating the wild vine, but improved varieties, many of which have parted with much of their wild character; and even if they had not, would these sticklers against progression be willing to plant vines with a small seedling parent tree by the side of each for its support, and then wait from ten to thirty years for the vine and tree to grow up together, at the end of that time getting no more in quantity with less in quality than they now compel a cultivated vine of three or four years to give them? If they are willing to follow nature in every particular, I have not the least doubt that any of the improved varieties will be found to grow and remain healthy without pruning or training. For my own part I take nature as a guide, the only difference being that I interpret her differently from that class of vineyardists who follow no system, and thereby are ever ready to thwart nature, but never assisting her.

There are certain general principles that govern the growth as well as the fruit-producing powers of the vine; and while all the operations in the vineyard should be subservient to them, the details in carrying out the necessary forms may usually be varied without materially affecting the final results.

The vine is one of the most tractable of all known fruit-bearing plants, and the easiest to control, although possessing apparently such a wild and rambling nature.

Its natural growth is upright, its tendrils furnishing ample means to assist it in climbing; and while it remains in an upright position, the larger portion of the forces of the plant are expended in producing a growth of wood and leaves, while fruit is produced but sparingly.

This fact we see illustrated in the wild vine, for it is not until it reaches a position where it can spread out horizontally that we find it producing abundant crops.

We see the vine in the forest, spreading over and envel-

oping like a mantle the towering oak, or covering the low alder by the water side, its clusters of fruit hanging in the shade beneath; and from it we learn several fundamental principles. 1st. That while the leaves require a full exposure to the sun, the fruit ripens fully without it. 2d. That while the vine grows upright it produces its most vigorous growth of wood, but its fruit-producing powers are not fully developed until it takes a horizontal position. 3d. That fruit is produced most abundantly upon the uppermost branches, and that it makes no difference whether these upper branches are on the tops of lofty trees or on the humble shrub. This proves conclusively that it is not, as some cultivators contend, the height that is necessary for the vine to bear well; for the fruit that is fifty feet from the earth is no better than when it is at five, other circumstances being equal. It only shows that the sap naturally presses to the top and forces out fruit-bearing branches at that point. I do not mean that the upper buds upon a one-year-old cane will produce fruit, for this they will seldom do, as they are not generally fruit buds; but if the cane is cut back to a well-developed bud, and remains perpendicular, or nearly so, then the upper bud is far more certain to produce fruit than those below it. Or if the young canes are bent (either by art or by their own weight, as we see them in their wild state) so as to check the flow of sap, and place the fully developed buds in a higher position than those at the end, then they will push out and produce bearing canes. Therefore the vine is said to bear its fruit at the top, as a rule, but it does not strictly refer to the uppermost buds. 4th. The fruit is produced upon the young growing canes, and opposite to the first few leaves that are formed; usually the first to third leaves formed will have a bunch of fruit opposite; sometimes they will extend to five bunches. When the shoot has produced its fifth leaf without showing signs of fruit, then none need be expected, for it is very seldom that fruit is produced

beyond that point. And as this rule is applicable to all the varieties and species in cultivation, it renders it an easy matter to regulate the quantity of fruit upon the vine at the annual pruning, by simply leaving a certain number of well-developed buds, estimating each one at so many bunches of fruit. Not only is the fruit produced near the base of the young canes, but the best buds for producing fruiting canes are found there also; for as these lower buds are formed early in the season, they become more fully developed than those formed later. Hence the necessity for cutting off the upper portions of every cane in pruning, instead of leaving a part of them at full length, and cutting others entirely away.

The foregoing are the main principles to be observed in pruning and training; but there are minor points also to be considered, because they are not only important, but are facts that have been proven to be well founded by long and careful experiments. These points will be noticed when I reach that part of the subject where they are particularly applicable.

The following system of pruning and training I believe to be one that may be applied to all the different varieties in cultivation with the best results. It harmonizes with the general development of the vine, and does not unnecessarily dwarf it, but keeps it perfectly under the control of the vineyardist, so that he can develop the fruit-bearing powers, and check the excess in the growth of wood, and so distribute the fruit that no one part of the vine produces more than another. It is not a new system, but its main features, which are the horizontal arms, and pruning the young wood to short spurs, have been in uninterrupted practice for more than a hundred years.

The following method of low training is especially recommended for vineyards, particularly where strong winds prevail and render it difficult to grow vines on high trellises. Plant the vines in rows, six feet apart, and the vines

eight feet apart in the row, and let but one cane grow the first season; keep it tied to the stake, and pinch back the laterals to concentrate the growth into the one cane. The rows may run east and west or north and south; perhaps east and west would be preferable in more northern localities, but the difference in this latitude is scarcely perceptible. If the rows run east and west, the leaves will be mostly on the southern side; but when north and south, they are about equally disposed on both sides of the trellis. Fig. 40 shows the vine as it should appear at mid-summer; A is a lateral that has been stopped three times; B has been stopped twice; C, but once. This cane is to be cut back the next season to within twelve to fifteen inches of the ground, and only the upper two buds are allowed to grow, all others being rubbed off. From these upper two buds two canes are produced, as shown in Fig. 41, each one of which should have the same treatment as did the single one of the previous season. The second season the vine will usually produce three bunches of fruit on each cane; and if it is strong and vigorous, these may be allowed to mature; but if the vine is not strong, they should be removed

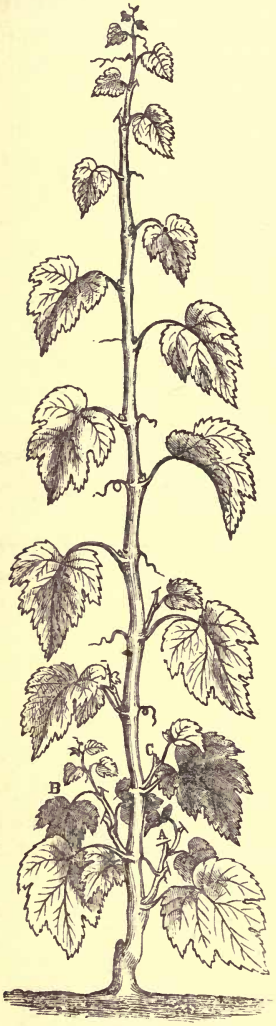

Fig. 40.

on their first appearance. The canes at this age should be from eight to twelve feet long, and at least half an inch in diameter. If much smaller than this, one of them should be cut away, and the other cut back to two buds, and two canes should be grown, as in the previous season.

When strong vines are planted, and good culture is given them, they will be ready for training at the end of the second season.

The trellis should now be built, if it has not been made before. (For description of trellis, and how it is built, see Chapter XIV.) The two canes of the vines are now shortened to four feet, bent down in opposite directions, and laid against the lower bar of the trellis to form arms. Select five or six of the buds on the upper side of the arms thus laid down, to be grown into upright canes, making a mark on the trellis bar opposite to each. If the vines have grown strong, the buds will be from four to six inches apart, in which case every bud on the upper side may be allowed to remain. From the marks opposite the buds stretch No. 16 galvanized wire to the bar above, fastening each end securely by winding about the bar or otherwise. Instead of now fastening the vine to the trellis, it is better, but not absolutely necessary, to bring the ends down near the ground, and fasten them there with hooked pegs, as seen in Fig. 42. If the ends are fastened to the lower bar in a horizontal position at once, the buds nearest to the base will usually push first, because the short bend in the cane at that point checks the flow of sap and forces it into the buds near

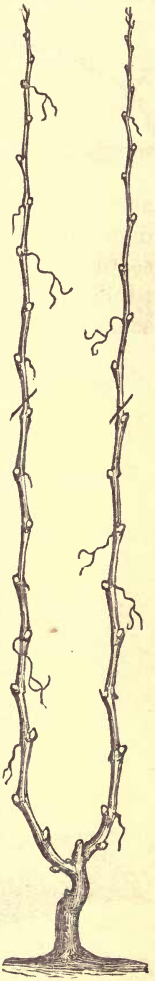

Fig. 41.

by, while the sap that flows past these buds goes rapidly to the extreme end of the arm, and forces the buds at that point into growth. In such cases the buds between those

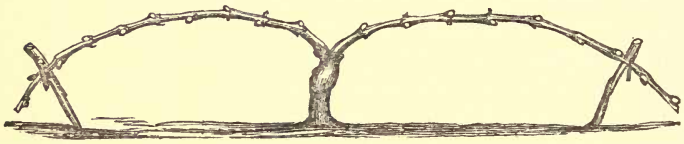

Fig. 42.

at the base and the extreme end will sometimes fail to produce canes. To avoid this we bend the canes as represented; this graduates the check which is necessarily given to the flow of sap, and each bud stands more nearly the same chance to get its proportion. When the buds have all started, and made a growth of two or three inches, then the arms should be brought up level and fastened to the side of the lower bar. All buds and shoots not wanted for upright canes should be broken off, and so soon as those remaining are long enough to tie to the upright wires, it should be done. They should not be tied too close, as room enough should be left for them to grow.

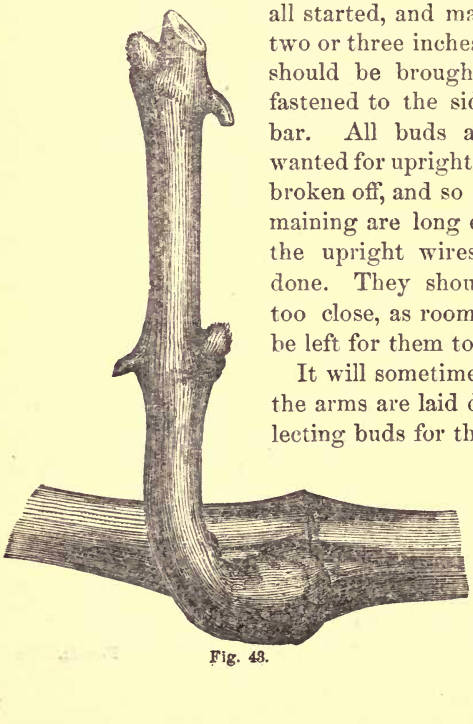

Fig. 43.

It will sometimes happen, when the arms are laid down, that in selecting buds for the upright canes, the spaces between would be made more nearly equal if an occasional bud on the under side was

used for the purpose; if so, it may be done, and it will do equally well, only it will not appear quite so systematical. Fig. 43 shows a spur produced upon a shoot grown from an under-side bud.

Each one of these upright canes will, if permitted, usually produce three or four bunches of fruit, and if the vine is very strong and vigorous, it will not injure it to do so. But unless it is very strong, it is better to cut off a portion and leave only one or two bunches to each cane. It is better not to overload the vine while young, as it will often seriously injure its future growth.

When the upright canes have grown to about two feet they should be stopped by pinching off their ends. I usually pinch off the end of the shoot so soon as it has made two leaves beyond the last bunch of fruit, which will be when the cane has from five to eight leaves upon it. But we can not expect to be exact, especially when there is a large number of vines to go over. Besides, one cane may grow more rapidly than another, and will need pinching sooner. Pinching will cause the remaining leaves to expand and become large, thick, and firm, and much better fitted to withstand the atmospheric changes than they would otherwise be. The shoots, after being stopped, will soon start, and after growing a few inches they should be checked again, as we wish to *keep* them within the limits of the trellis, and not allow them to grow much, if any, above it. All the laterals on the canes should be stopped as though they were on young vines. Fig. 44 represents a vine at the end of the first season after the arms are formed. The first upright cane at the left hand of the center shows the position of the three bunches of fruit. Upon this vine there are twelve upright canes, six upon each side, which are distributed on two arms of about four feet each; it is not expected that the arms will be of an exact length, but they need not usually vary more than three or four inches. Nor do we expect to have the upright canes exactly the

same distance apart, but if care is taken in the beginning in selecting the buds there will be no material difference. No more fruiting canes should be allowed to grow on one

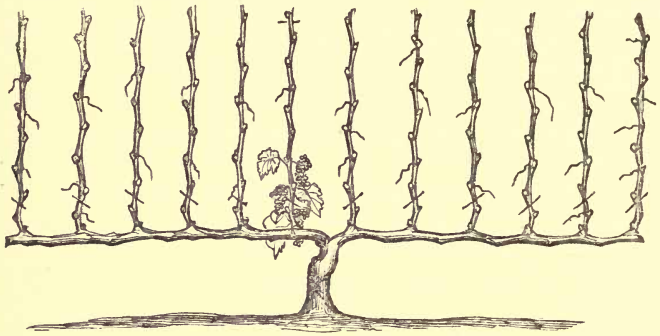

Fig. 44.

arm than upon the other, nor should any number of the canes be allowed to grow higher than the others, and thereby appropriate more than their due share of nutriment. Keep the vine equally balanced in fruit, foliage, and wood. The vine referred to above has six upright canes, which, if evenly distributed, would give eight inches space between each, which is abundant for those varieties that have leaves of moderate size. But with those that have very coarse wood and large leaves, the distance between the upright canes should be ten or twelve inches.

The upright canes are pruned back the first year to two buds; the small cross lines near the base of the canes, Fig. 44, show where they should be cut. The next year a cane will proceed from each of these buds, and all other shoots which may start from the small buds near the arm should be rubbed off. Or, if the buds should produce two shoots each, as they will sometimes do, only the strongest one should be allowed to grow.

The second year the two canes will each produce three or four bunches of fruit, and instead of twelve upright canes

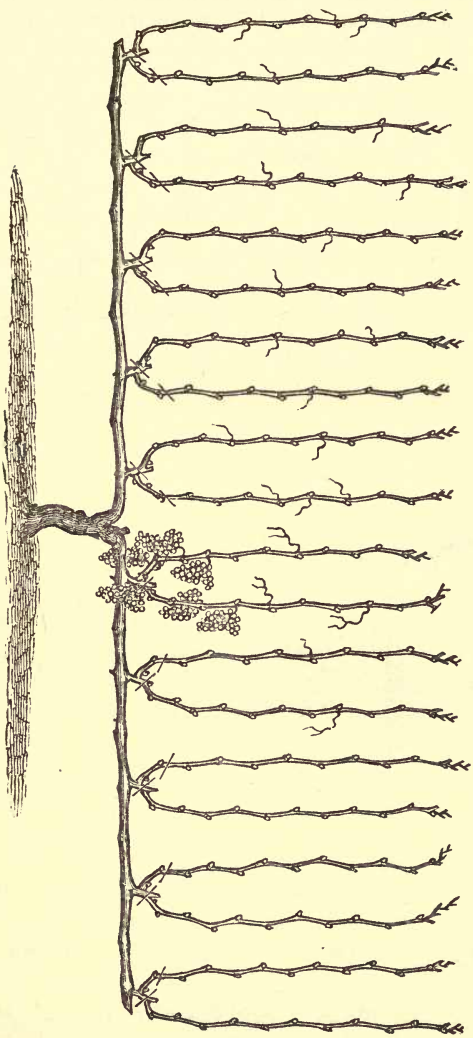

Fig. 45.

we now have twenty-four, and allowing three bunches of fruit to each, it gives seventy-two bunches to each vine, and this is not an over-estimate for the product of a vine the fourth year after planting.

Fig. 46.

The canes are to be treated the same, as regards stopping, pinching, laterals, etc., during each year of their growth.

Fig. 45 shows a vine at the end of the fourth year, but with only five spurs with two canes on each, making ten bearing canes on each arm. The first two canes at the right hand of the center are represented with the three bunches of fruit upon each. The cross lines near the base of the shoots show where the vine is to be pruned at the end of the fourth year. The uppermost of the two canes is cut entirely away, and the other is cut back to two buds.

Fig. 46 shows this same vine as it appears after being pruned. The vine in subsequent years is to be pruned in the same manner. Fig. 47 shows a portion of the arm with the base of the upright shoot or spur, as it is called. The cross line shows where the upper cane is to be cut away. Each year the pruning should be reversed if the position of the lower bud will admit of it. That is, if we cut away the left-hand cane this season, as shown in the last figure, then we should cut away the right-hand cane the next; in this way the spur will remain nearly upright. But sometimes the lower bud will be on the outside of the shoot which we wish to keep for the fruit spur. Fig. 48 shows a spur with the

buds in that position ; but we must prune the spur just the same as though it were on the opposite side, and probably the next season the buds on the young shoot will be

Fig. 47.

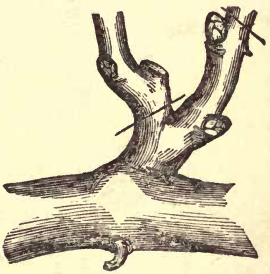

Fig. 48.

reversed, and we shall be able to bring our fruit spur again into a perpendicular position. The lower bud will seldom be produced two years in succession on the outside, as shown in the above figure.

It is desirable that the shoot from the lower bud on the fruit spur should grow strong, as it is from this that we take the two buds for the next season's fruit spur. As this first or lower bud is seldom more than one inch from the base of the shoot, and in many of our best short-jointed varieties not more than a half-inch, it is obvious that we lengthen the spur each year only the distance from the base of the shoot to the first bud on it, be it more or less. The annual increase in diameter of the arm, as well as that of the spur, also lessens somewhat its projection above the arm. Taking the average of some twenty varieties that I have trained on this plan, I find the spurs do not increase in length more than three fourths of an inch each year. At the end of the fourth year the vine is considered as established, and as another vine is at the same distance from it with arms extending each way, of course the space is all occupied, and the vines are to be confined within the limits of eight feet each. The rows being six feet apart,

we have nine hundred and five vines on an acre; now seventy-two bunches to the vine (which every vine will bear if it is a productive variety, and if it is not it had better be discarded at once, unless it possesses some extraordinary quality which makes up for loss in quantity) will give us 65,160 bunches to the acre; the weight of course will vary according to the size of the bunch. Thirty pounds to the vine the fourth year is not an unusual crop for such varieties as the Concord, Hartford Prolific, Catawba, Isabella, etc. But it is not best to let the vines bear too much while young, as the quality of the fruit will not be as good as though a less quantity were taken; besides, it is very likely to severely check the growth of the vine.

Varieties that are not as strong and rapid growers as those named, may be planted nearer together, say six feet apart in the row, and the rows only five feet apart, and it is not necessary that the trellis should be so high by half a foot, at least; two feet and a half between the bars will be sufficient for many of the shorter jointed varieties. Sometimes the vines are planted more than eight feet apart, and only a part of the arm is formed the first year, and the upright cane nearest the end is laid down the second year, and the arm thus lengthened in this way until the required length is obtained. But having tried both, I much prefer planting the vines so near together that arms can be formed to fill up the space at once.

Four feet is about as long as it is safe to lay down a cane at one time and have all the buds start evenly.

When the vine becomes old and very strong, the amount of fruit may be increased by pruning, so as to leave three buds upon the spurs, as is shown in Fig. 49; this will increase the crop one third. But there is danger of losing the lower bud if we increase the number beyond this, as we find that the tendency of the sap is continually to the upper bud; and when there are several left on the spur, the lower one is apt to be robbed by those above it, and

more likely to remain dormant than when we prune back to two or three.

If the lower bud fails to grow, then we have to depend

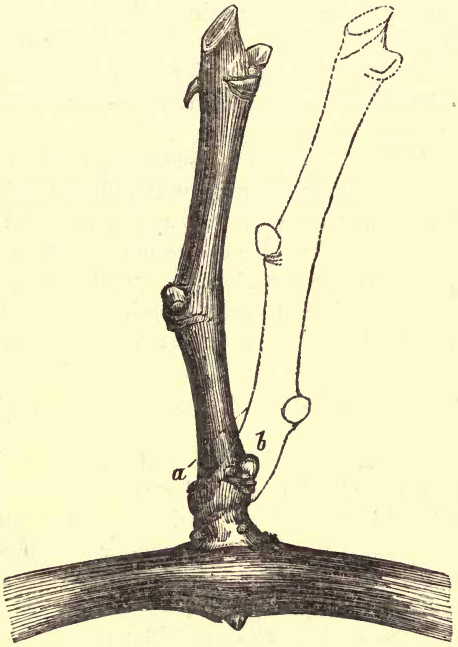

Fig. 49.

upon the first growing one above it for the fruiting cane for next year; this will add very materially to the length of the main spur, besides injuring the general appearance of the vine. In the above figure the dotted lines (*b*) show the position of the young cane that should grow from the lower bud, and a similar cane will be produced from each of the other buds.

The cross line at *a* shows where the old spur, with the two upper shoots, which are now only buds in the engraving, will be cut away at the next year's pruning, and the

three buds now on the cane, *b*, will be left. Too much care can not be given to the preservation of these spurs on the arms, for if one is broken off or destroyed by injudicious pruning, there is no certainty of replacing it, although buds will sometimes start from the arm near its base, and from this a new spur may be formed; but it is better to preserve the original spurs than to endeavor to replace them with new ones.

Should the spurs ever become so long as to be unsightly or inconvenient, new arms may be readily formed by allowing the two center spurs to produce but one cane each, and these may grow four or five feet long; at the next pruning cut away the old arms and bend down these two canes to form new ones. But if the plan which I have given is strictly followed, the arms need not be renewed oftener than once in fifteen or twenty years.

There are several reasons why I believe the foregoing method is one of the best, if not *the* best system for general vineyard culture. 1st. The horizontal is the best position that can be given to the vine to develop its fruiting powers, —the main object in all the various methods of pruning and training. 2d. The upright bearing canes being equally distributed on the arms, no one portion of the vine has any advantage given it over another, the flow of sap being equal to all parts. 3d. The equal distribution of the fruiting canes not only allows a free circulation of air among the leaves, but insures an equal distribution of fruit. 4th. While the vine is restricted within certain limits it is not dwarfed, as some might suppose, for a vine with two arms, four feet long, with ten upright canes on each, making twenty canes three feet long, has sixty feet of wood to be grown and pruned off each season. This quantity is certainly abundant to give the most vigorous growers sufficient expansion to insure a healthy action of root. Some cultivators suppose that because a vine will grow large and occupy considerable space, if allowed sufficient time and

furnished with plenty of nutriment, that it can not remain healthy if it be restrained within moderate limits. But this is a great mistake, and the sooner such ideas are abandoned, the better it will be for the cause. 5th. The vines being trained low, the fruit receives a greater amount of heat than if more elevated, because it gets not only the direct rays of the sun, but also the heat reflected from the earth. This last is quite important in a northern climate, where there is little danger of getting too much heat. 6th. The mode is so simple that the most inexperienced may understand it; and when the vines are once put into shape, the pruning ever after is so nearly the same, there is scarcely any danger of going wrong.

Fig. 50 represents a two-tier system of training upon the same principle. It is equally as good as the single tier of arms, but it usually requires one year more to perfect it, and the trellis must be made considerably stronger, as its height offers more resistance to the wind than in the former mode of low training.

It has one advantage over the other mode, as a larger number of vines are planted to the acre, producing consequently an increase in amount of fruit. It is particularly valuable where land is very expensive, and the greatest amount is desired from a given space. The vines are planted four feet apart in the row, and the rows eight feet apart, which gives 1,361 per acre.

When the vines are pruned for forming the arms, every alternate vine is cut back to within one foot of the ground, and the others at the height of four feet; the upper two buds on each one are allowed to grow, and from these the arms are made. Those that start at one foot from the ground are bent down for arms on the lower bar, and those at four feet are taken for arms on the middle or second bar; both sets are treated as directed for training a single vine. Sometimes those vines that are left four feet long will not produce canes sufficiently strong the first season to make

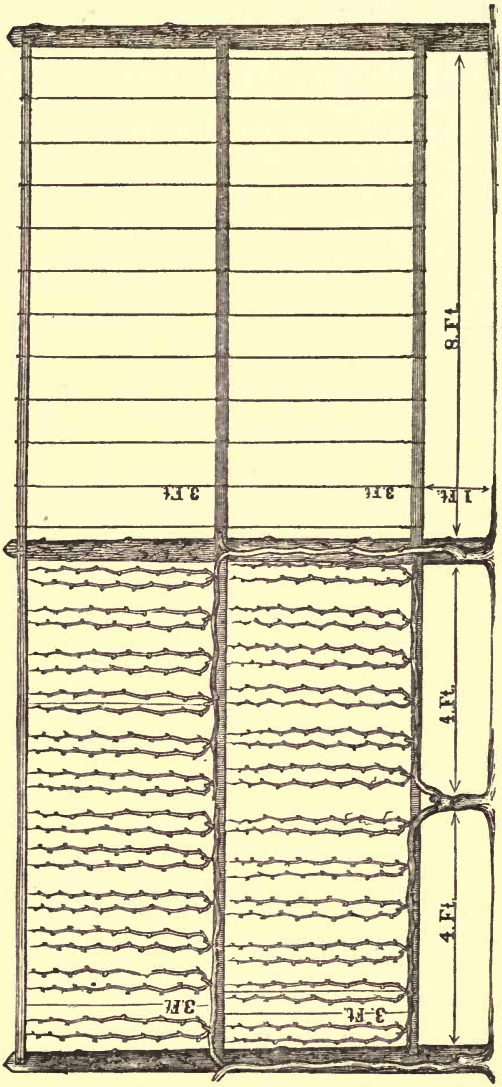

Fig. 50.

the arms; if they do not, then they must be cut back a second time, or until canes are produced that are strong enough for arms.

The engraving shows the vine and trellis complete, except that only one arm is shown on the vines on the upper tier. The posts are eight feet apart, and they may be set opposite to every alternate vine, as shown, or mid-way between every other vine; it is better to set them between the vines, if the trellis is not built until after they are ready to train, because at that time it will be difficult to set the posts near the vines without disturbing the roots.

Each vine has but two arms, and the number of upright fruiting canes should be the same on each arm, the vines being treated in every respect as described for the single tiers.

The vine at each end of the trellis will have but one arm, whether it happen to be on the upper or lower tier.

The trellis is represented as being seven feet high, the lower bar being one foot from the ground, and the other two three feet apart; this allows of three feet growth to the upright canes, which is sufficient for the strongest growers; but there are many varieties that are short jointed, for which two feet will do. And in locations that are low or very level, it is better to place the lower bar eighteen inches or two feet from the ground, so as to insure a better circulation of air among the lower leaves; besides, in some very fine soils, the fruit on the lower tier will get spattered during heavy rains unless the ground is mulched. But there is no need of ever making the trellis higher than seven feet in a vineyard, and there is much inconvenience attending the tying of the vine on a trellis the top of which can not be reached while standing on the ground.

When it is desirable to have the lower arms more than one foot from the ground, and still reserve three feet space for the upright canes, it may be done in this wise: place the lower bar two feet from the ground, the next three

feet above it—we now have two feet remaining between the middle and upper bar.

The upright canes from the upper arms may be allowed to grow one foot or more above the trellis without support, and they will receive no harm therefrom. Where it is desirable to economize in every way possible, the trellis may be made only six feet high (provided the lower bar is placed at one foot from the ground), and the bars arranged so that the shoots from the upper tier may be allowed to grow above it.

Whenever any of the upright canes show a weakness, the pinching may be deferred until they gain the required strength. If the ends have already been pinched off, then leave two or three of the upper laterals to grow out for a foot or more, and this will cause an extra flow of sap into such canes, and thus we may check one cane and encourage another. In this manner we can readily control the forces of the vine, directing them to whichever part best suits our purpose.

In checking the growth of vigorous vines, especially when young, we will sometimes cause the main buds on the young canes to throw out fruit branches in the latter part of the season, and on these will appear a second crop of fruit. This of course is of no value, because there is not sufficient time for it to ripen, even if the strength of the vine would admit of its doing so. I mention the fact only because some inexperienced persons may be alarmed by seeing a second crop appearing upon the vine in autumn. This second crop is certainly produced from buds that would, under ordinary circumstances, remain dormant until another year, but checking the growth has forced them out before the proper time. If every main bud on the young canes is forced into growth, except the two or three lower ones, no harm is done, for these last are all that are needed; the others we prune off at the end of the season. There is little danger of the lower buds starting, particu-

larly on fruiting canes. I have often severely checked fruiting vines, sometimes stopping the young canes at the fourth bud, but even this did not cause the lower two buds to start. And when the canes are not pinched until they have produced their fifth to eighth leaf, as I have recommended as the general rule, then there is not the least danger of any of the lower buds pushing prematurely into growth.

If the young canes are allowed to grow unchecked, the lower bud upon them will seldom become sufficiently developed to produce a vigorous fruiting cane the succeeding year. That it should be so developed is all important when vines are trained with horizontal arms and spur pruned, and in no way can this be accomplished except by checking the cane while growing.

To the novice this stopping of the young canes, tying, pinching laterals, removing tendrils, etc., may appear to be a tedious and expensive operation, and sometimes, when vigorous growing varieties are planted in very rich soils, it is so; but under ordinary circumstances, when the vines become fully established, very little trouble will be experienced upon this point.

The young canes will have to be stopped about three times during the summer, and at the time of doing this the laterals, if need be, should be pinched and tendrils removed. On old vines the laterals will seldom need stopping more than once, unless they are overdosed with manure.

OPPOSITE ARMS.

In cutting back the young vines for the purpose of producing two shoots for arms, it is apparent that the upper two buds will not be exactly opposite, and that one of the arms will be higher than the other. This may be remedied somewhat by bending the short piece of two-year-old wood at the base of the upper bud; but this can not always be

turned at an angle so short that one of the arms will not be a little higher than the other. It is no great matter if it is, but when it is desirable to have the arms appear to

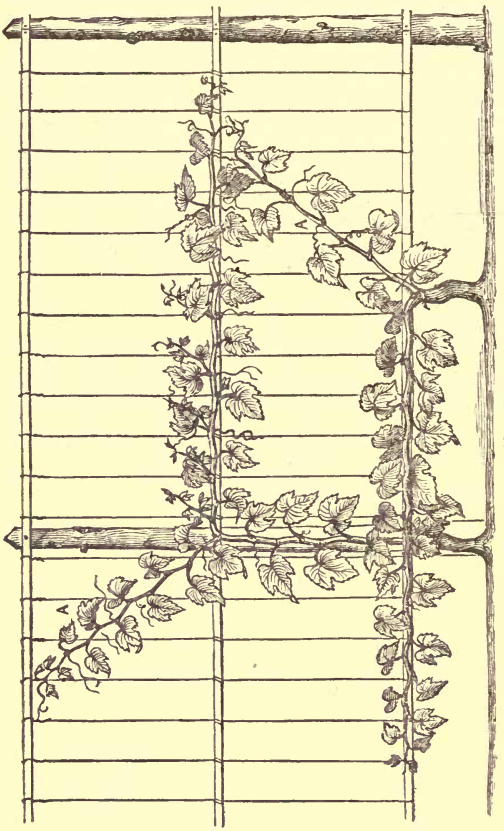

Fig. 61.

start from the same point, the vine may be treated in the following manner.

When the vine is strong enough to make arms, it should be bent down into a horizontal position and tied to the bar

of the trellis, all the laterals being stopped except the one at the angle near the bar.

Fig. 51 shows two vines upon a two-tier trellis; A, A, are the two laterals that have been allowed to grow unchecked. The bending of the growing canes will check the flow of sap in them, while the laterals, A, A, will grow very rapidly.

If the vines are vigorous and the canes are bent down in midsummer, the laterals will often grow sufficiently strong by fall to make the arms. If they do so, cut them off at four feet and tie them to the bars, the same as the main canes. The two arms will then appear to have started from the same bud. But if the lateral does not grow sufficiently strong to be used for an arm, it should be cut entirely away at the time of the annual pruning.

The main cane on the lower bar should be cut off where it crosses the vine next to it, and the cane on the upper bar at a point directly above the main trunk of the lower vine. Fig. 52 shows the vine on the upper bar when pruned, in case the lateral failed to make an arm, excepting that when it is done it is devoid of leaves. If we fail to get an arm from the lateral the first season, we may allow the main cane to remain in its position, and permit so many buds to grow from it as we desire for the upright fruiting canes; but the bud which is at the base of the lateral, A, we will allow to grow up until long enough to make the arm in place of that which we failed to get from the lateral. At the end of the second season we bend this down and form an arm precisely as would have been done with the lateral; and the vine will appear the same, except that one of the arms is one year older than the other, and of course it is considerably larger. To remedy this difference in appearance, the upright canes on the two-year-old arm should be cut back to one bud instead of two, as would have been done if both arms had been perfected the first year, allowing only single upright canes on both

arms this season. The cane that is bent down the first season will usually produce fruit the second; but it is best not to let it produce more than one bunch upon each upright cane, unless it is very strong. The object should

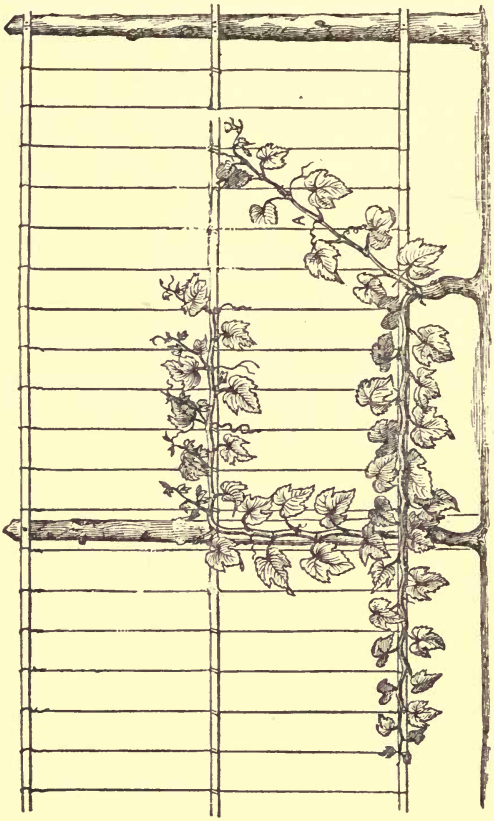

Fig. 82.

always be to subdue the vine but not to weaken it, and if it is necessary to commence training it the first season after planting, it should be done; and it is far less trouble to get control of the vine while young, and there is less

danger of injuring it than if we wait until it has spread its roots and branches far and wide before we undertake to confine it within certain contracted limits.

This fact should be borne in mind, that the expansion and multiplication of roots depend as much upon the extent and number of branches that are allowed to grow, as the growth of the branches does upon that of the roots.

Therefore to control the whole plant we have only to control the top, and this is done chiefly by checking the branches while growing, for if the vine is allowed to perfect its canes, it will certainly perfect a corresponding number of roots, each of which is capable of absorbing a certain quantity of nutriment, and sending it upward into the branches; and every year that the vine is allowed to grow unchecked, so much more does it increase the difficulty of bringing it under control.

OBLIQUE ARMS.

In many parts of the country the grape vine is not sufficiently hardy to withstand the cold of winter without protection, and there are very few locations in the Northern States where this would not be beneficial to many of the varieties now in cultivation. Even if the vine itself is not materially injured, the fruit buds are often so weakened by cold that they fail to produce as much or as good fruit as they otherwise would. With the systems of training that I have given and others frequently adopted, it is not only inconvenient to protect the vines, but it would also be very expensive. There is no method of protection that is so cheap or practical as that of laying down the vines and covering them with earth; but to do this they must be trained in such a manner that they may be bent down without breaking the main stem or otherwise injuring them.

When trained with the two arms, they can not be laid down without bending the main stem over to one side,

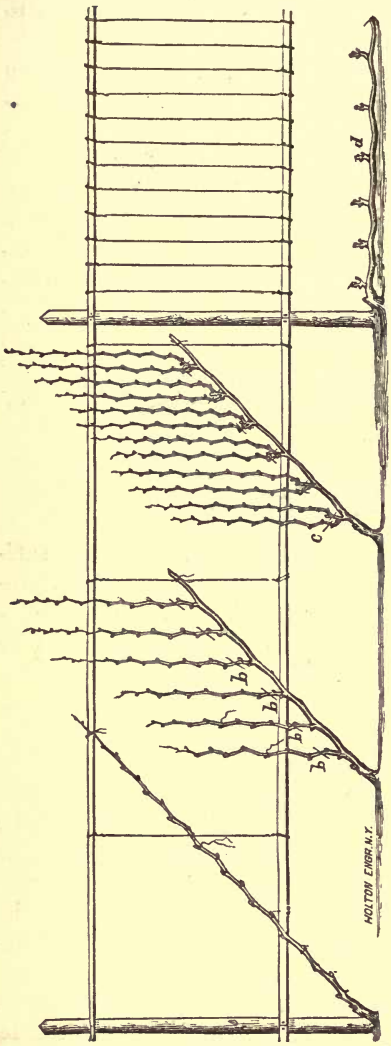

Fig. 68.

which would be difficult to do, particularly after the vine has become large. The vine may be trained with one arm, and this could be laid down more conveniently than when there were two; but still it can not be laid flat without bending the main stem, or straightening the angle which is formed in making the horizontal arm. To surmount all the difficulties met with in the common modes of training, and still continue upon the arm and renewal system, I have adopted what I call, for the want of a better name, the oblique system. The vines are planted three feet apart in the row, and the rows six feet apart; this allows 2,074 vines to the acre.

The vines are planted in the same

way as for other modes of training, and but one cane allowed to grow the first year. In the fall the vines are cut off to about four feet, and laid down and covered with earth—four or five inches deep is usually sufficient. The next spring remove the earth and straighten up the vine. Build the trellis in the same manner as described for low-trained vines with two arms; that is, four feet high and three feet between the bars. Fig. 53 shows the system in its progressive stages. The vine on the left shows the one strong cane at full length; the next vine after it has been pruned, and with the single upright bearing canes; the third vine as it appears complete at the end of the third year; the fourth vine (*d*) shows the same pruned and laid down ready for covering.

If good strong vines are planted, the system can be brought to completion in the third season; but strong and vigorous canes must be obtained in all cases before commencing the training. The vines are trained at an angle of forty-five degrees, and the bearing canes being perpendicular, they consequently make the same angle with the vine that the vine does with the ground.

This is the highest or greatest angle to which vines can be carried without giving the upper shoots on the arms so much the advantage over the lower ones that there will be no certainty of the lower ones pushing into growth without bending or otherwise distorting the canes.

We will suppose that at the end of the first season we have a vine as shown at the left of the engraving. It is then laid into position as seen; we then cut it off at the point where it crosses the perpendicular wire, leaving it an inch or two beyond it, so that it can be securely tied. The cane when cut off will be about four and one half feet long. It may now be laid down by the side of the trellis and covered with earth. In the spring take up the vine and tie it to the trellis; and to be sure of getting the correct angle, let the point where the cane crosses the lower bar and the

point where it is tied to the upright wire be both equal distances from the base of the wire. The vine should be made as straight as possible, so that the sap shall not be checked in its flow. If it is not disposed to be straight, a lath should be nailed on, reaching at the proper angle from the lower to the upper bar, and the vine tied to it. When the buds start, select five or six for the upright canes, the same as when the arms are trained horizontally.

The first upright may start a few inches below the lower bar, as shown in the engraving, or the bar may be placed at six inches above the ground, provided the soil about the base of the vine is kept covered with mulch to keep the fruit clean. Each of the uprights will produce fruit, but unless the vine is very strong, a portion of it should be removed.

The flow of sap will sometimes cause the upper shoots to grow a little faster than the lower ones; if so, pinch off the ends so soon as the fifth leaf is formed on them, and leave the lower canes until they have eight or nine leaves. The growth of the canes will usually be very regular when the vines are laid in straight, and at the angle named.

At the end of the second year the bearing canes should be pruned to two buds; the cross lines at *b*, Fig. 53, show the point where to cut off.

As the vines are to be protected, there is no necessity for leaving an extra bud to be cut off in spring, as recommended for unprotected vines. In locations where it is necessary to protect vines, the warm weather usually comes on so rapidly after it commences, that it would not do to prune the vines after they are uncovered.

The next season two canes are produced from the two buds, and in the fall the cane which starts from the upper bud of the two is removed, cutting through the spur as previously shown, and the other cane cut back to two buds; the cross line at *c*, Fig. 53, shows the point at which it should be removed. Upon the right hand of the figure,

and over the vine that is laid down, the trellis is shown as it appears with all the perpendicular wires.

The trellis, as here shown, is only two feet between the bars and its whole height only three feet, the upright canes on the upper portion of the arm being allowed to grow above the upper bar. This they may be allowed to do when it is desirable to practice the strictest economy.

Fig. 54 shows a space of twelve feet as occupied with four vines trained with oblique arms; only two posts are represented, but it is best to place the posts not more than eight feet apart. When a row of vines trained on this system is pruned and laid down, the vines will overlap each other a little; but the end of one may be laid by the side of the trunk of the next, and so on throughout. In lay-

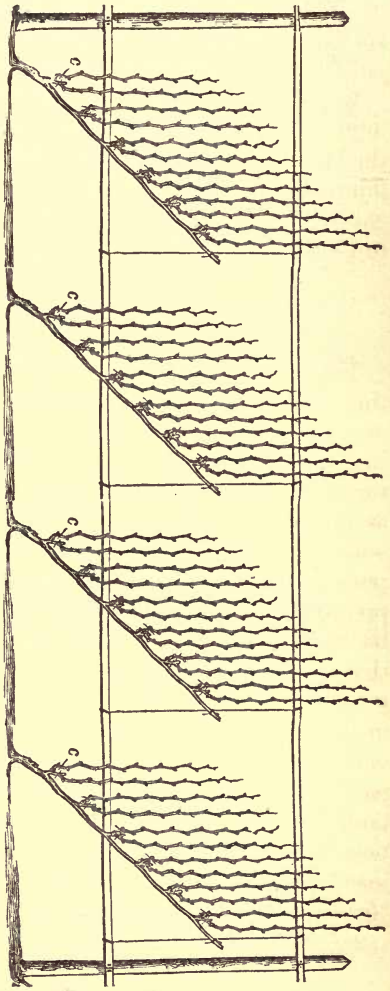

Fig. 54.

ing them down, one person should hold down the vine while another covers it, and as the vine has to be bent only one half the distance that it would be trained upright, there is no difficulty in laying it down quite flat. No straw or any similar material should be used in covering the vines, as it only furnishes a harbor for mice.

If the soil is so wet and heavy that there is danger of injury to the buds, a little sand should be put on next to the vine before the earth is put on. The buds will not be injured in any ordinary dry soil, provided the vines are not covered until the ground becomes cool, and are not allowed to remain in the ground too late in spring.

A PLAN FOR POOR SOILS.

There are many light sandy and gravelly soils wherein the grape will not grow vigorously without the application of a large amount of fertilizing materials, and it is often the case that the cost of such materials would put grape culture out of the reach of persons in moderate circumstances, as well as make it an unprofitable investment for any one who should undertake to grow them under any of the systems in practice at the present time. Having stated on a preceding page that the expansion and amount of root may be restricted by controlling the top, it must be apparent that by increasing the quantity of root we can add to the growth of the branches. The following system is founded upon this well-known principle, and it is recommended only for light, poor soils; because, if practiced even upon moderately rich soils, an over-luxuriance would almost certainly be the result. When this occurs, the richest and best flavored fruit is never obtained. The plan is as follows: plant the vines four and one half feet apart in the rows, and the rows six feet apart, and if the soil is *very* poor, add to it at the time of planting a few shovelfuls of

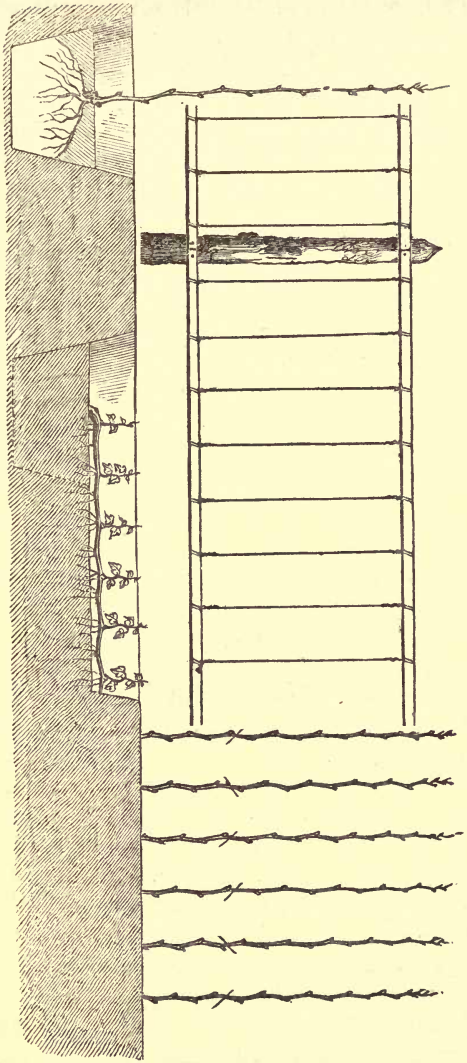

Fig. 55.

manure and two quarts of bone dust, mixing it with the soil as it is put around the roots.

Let but one cane grow, and keep tied to a stake. The first point to be gained is to get one cane six to ten feet long, and if not obtained the first season, cut back and try again. So soon as we have obtained the strong cane, it should be cut back to four feet and then layered. This operation should be performed in the spring in the following manner: dig a trench five or six inches deep, running from vine to vine, bend down the vines and fasten them in the bottom, and leave them uncovered.

There should be a space of a few inches between the end of each vine when layered and the next one in the row; and if planted four and a half feet apart, and the cane left only four feet, a space of six inches will be left.

When the young shoots have made a growth of an inch or two, select from four to six for upright canes, and rub the others off. Put a stake to each, and so soon as it is long enough, tie it up. When the young canes are one foot high, an inch or two of soil may be put in around them, and some more compost or bone dust be mixed with it. The trench may be filled up gradually until it is full. Fig. 55 shows the position of the vines; on the left hand is shown the vine with the one cane; the next vine to the right is the same laid in the trench, with the young shoots a few inches long; the third shows the vine in the fall, with its canes at full length, and the trench filled. The small lines crossing the canes show where they are to be pruned in the full, that is, two buds above where they are pruned at the regular annual pruning. The next season the upper two buds on these canes should be allowed to grow, and the others removed; at the end of the season the vine will appear as shown in Fig. 56, which represents the same on a larger scale, and for want of space but five of the canes are shown.

These canes are now treated the same as though the arm

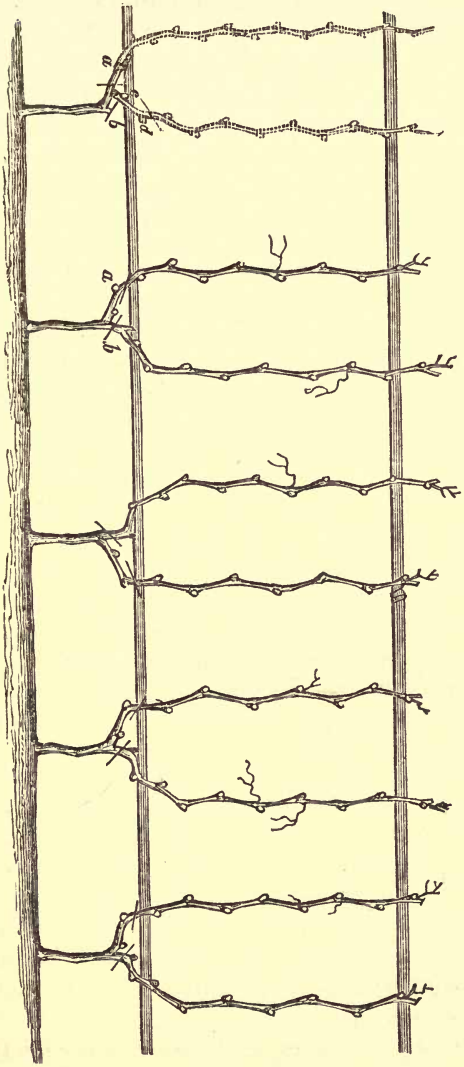

Fig. 56.

were above ground and fastened to the lower bar, instead of being a foot and a half below it. The vine is spur-pruned, but the spurs are eighteen inches long at the commencement. By referring again to Fig. 56, in the second vine from the left hand, *b* shows where the one cane is to be cut away, and *a* where the other is pruned to two buds. The first vine at the left is shown as it is supposed to appear at the next year, or after it has been twice pruned. It was cut off at *b*, and the two canes were produced from the two buds left. Now the left-hand cane is cut away at *a*, and the right-hand cane pruned off at the line just above the lower bar, leaving the buds (*e*, *d*) to produce two more arms. The vines are pruned the same each year as though they were short spurs upon horizontal arms.

If six canes are left on such a vine at first, it will be necessary, after two or three years, to cut out every other one, for they will require more room as they increase in size. But the amount of fruit need not be lessened, for instead of two canes from each vine, they may be allowed to carry four, or the number may be increased to six or eight, but each one of these, in pruning, should be cut back to two buds. When it is desirable to increase the number of canes, it is only necessary to prune each one to two buds, instead of removing one of them entire, as is usually done in pruning to two buds.

The increased strength which is given to the vine treated in this manner is very considerable, because roots issue from every portion of it that is buried, and each spur is not only furnished with roots at its base, but it also has the assistance of the original roots. Vines that are naturally but feeble growers at best, will grow strong and vigorous when layered as I have described. It is also very easy to protect vines when grown in this manner, especially if the spurs are kept within a foot of the ground. Let the rows run east and west, then nail a board of sufficient

width to come above the spurs on the north side of the trellis, and at the approach of cold weather put another on the south side, and the space between may be filled with tan-bark, sawdust, sand, or soil, or the narrow space along the top may be covered with any old strips of sacks or similar material. The most that is usually needed is to keep the vine from frequent freezing and thawing.

The amount of fruit obtained per acre is about the same as with the system of low training with two arms, but it requires double the number of vines in the beginning.

The same style of trellis is used as for the other systems, and the same amount of pinching of the fruiting canes and stopping of the laterals is required.

The four systems that have been described are the same in principle, only the details are varied to suit different circumstances, and these details may be varied indefinitely, so long as we do not undermine the foundation upon which the structure is built.

CHAPTER XVI.

GARDEN CULTURE.

The greatest obstacles in the way of cultivating the grape in gardens, particularly in cities and villages, are, the want of circulation of air and the excess of shade, or both. Still, with these difficulties there are some advantages: protection from cold in winter, and greater heat in summer, which cause the fruit to ripen early, so that upon the whole there is about the same chance of success in city gardens as in the open country.

There are few gardens either in city or country where there may not be found a sunny spot sufficiently large to accommodate a few vines. It is often the case in cities that the only spot that the sun reaches in the whole garden is covered with a brick or stone walk. When this is the case, it does not prevent the planting of the vine, as the walk may be taken up, the soil beneath it made deep and rich, the vine planted, and the walk re-laid, leaving the top of the vine coming out at one side. Or the vine may be planted on the side of the walk, and kept trained to a stake until it has produced one long stout cane. Then take up the walk between it and the building or wall on which we desire to train it, remove the poor soil and substitute that which is rich, for two feet wide and the same in depth, and lay down the vine in this, bring up the cane on the other side and replace the walk.

This is a much better plan than to place the roots near or against the foundation of a building, because in such a position they usually receive too much heat in summer and are too wet in winter.

The roots of the vine will grow as readily under a pave-

ment as anywhere, provided the soil is not too wet; the surface of the soil being covered, it seldom becomes dry, and the pavement absorbs a great amount of heat, which passes through it to the soil, furnishing sufficient to keep up a healthy action of the roots. The most important thing in preparing a place for a vine is to secure proper drainage, because where there is much shade the soil is usually very wet; and to avoid injury to the roots from excess of moisture, deep trenching or drainage is indispensable. It may not always be necessary to dig very deep at the exact point where the vine is to be planted; in fact, this would more often be injurious than otherwise. But let the deepest digging be at some distance from it, so that the water as it descends may be carried away from the vine, instead of being drawn under it.

One of the most common errors committed in tree as well as vine planting, is that of digging deep holes at the point where the plant is to be set, and then filling them up with loose soil, and in this place the roots. These holes only serve to drain the surrounding soil, receiving moisture instead of repelling it. This would certainly be beneficial in very porous dry soils, but in wet ones it is injurious. If the ground can not all be trenched, let the holes be made large, and at the point where the vine is to be set, not more than eighteen inches deep, and at the outside two feet deep; this will cause the water to settle away from the vine. When the soil is very heavy, it is best to dig a trench and set the vine at one end, letting the bottom of the trench descend from the vine to the farthest point; any old rubbish, such as brick, stone, bone, etc., may be placed in the bottom of the trench to secure a better drainage. When a number of vines are to be planted, a long, wide, and deep trench should be made and filled with good soil; this will make what is usually termed a *border*. Four feet wide and two feet deep will answer every purpose, unless the method of training to be adopted requires the vines to

be planted very near together; if so, then it may be necessary to make the border six or eight feet wide.

When the border is first made, it should be a few inches above the level of the surrounding surface-soil, as it will usually settle, and frequently require a considerable addition of soil to prevent it being too low. If the border was made only level with the surface of the garden, when it settled it would carry the vines down with it, and when filled up, the roots of the vines would be buried too deep. When an outlet can be secured, either into some hollow or sewer, it is well to lay a drain along the bottom at one side of the border. This drain may be made of tile, brick, or stone, and should descend at least one foot in a hundred to secure the rapid passage of the water.

Drains made of stone should be covered with sods, straw, wood shavings, or some similar materials, before the trench is filled, as these will prevent the fine soil entering and filling it up. In wet and heavy soils it is a great point gained to secure a thorough and permanent drainage.

The materials used in making the border may be the same as are used in the vineyard, but as they are not always to be had, others may be used, avoiding always all fresh unfermented manures. If old manures can not be had, make the border entirely of soil, and if clayey, add sand; use ground bones and charcoal to put around the roots when first planted, and then apply the fresh manure to the surface, forking it in after it has become rotted. A little lime, plaster, or ashes may be added to the border, but not in any great quantity, as there is more danger of applying too much of such materials than too little. There is usually an abundance of materials about a city or village that may be used for manure, but most of them should be used with caution, as it is difficult to determine what injurious ingredients they may contain. It is much the safest way to use stable manure, when it can be had, or in place of it, ground bones, poudrette, etc., adding sods,

leaves, or charcoal, as much to lighten the soil and make it more friable, as for their fertilizing qualities.

One of the most pernicious practices in cities is, the continual drenching of the grape borders with slops from the house; this has become common from the well-known fact that they often contain a large amount of manurial ingredients. But the large amount of water accompanying them usually renders them more injurious than beneficial.

An occasional application of this kind may be of service, if the borders are well drained; but a better way of saving such materials is to dig a hole or make a cistern in some out-of-the-way place, then add charcoal or dry muck sufficient to absorb the moisture, and when the place becomes filled, take out the manure, add a little plaster, and then it is ready for use. In this manner it becomes deodorized and is really an excellent manure for the vine.

There is one other point upon which a word of caution may not be amiss, namely, not to apply top-dressings of strong manures in summer, for this will usually cause the vines to produce a late growth, which it is always desirable to avoid. The best time to apply a top-dressing is in the fall, as it then serves to protect the roots during the winter, and the fertilizing materials are carried down by the rains, and ready for use when the vine starts in the spring, and a steady uniform growth is insured. It is not advisable to grow any plants except the vines in the border; but where there is a scarcity of room, a few bulbous rooted or annual plants may be grown. If they are of the latter kind, it is best that they should be trailing plants, such as verbenas, portulacca, etc., as these spread over the soil and operate in a measure as a mulch; still, they absorb more moisture from the soil than their shade assists in retaining. No deep-rooted perennial plant should be planted near the vine. Neither should large shrubs or trees be placed where they will continually shade the ground, for the roots of the vine as well as the branches require warmth.

POSITION OF BORDER.

The position of the border will depend somewhat upon that of the garden; but any exposure except a direct northern one will do, and even this will answer provided the place is not in the shade more than half the day. The best position, however, is upon the south side of a building, or high fence, or wall. An eastern or western exposure will answer every purpose, because the heat and light are far more intense in such positions than in the open vineyard.

TRAINING THE VINES.

When the vines are grown in large open gardens, where there is plenty of room, the same general system of training may be followed that has been given for the vineyard. The two-tier system, as shown on page 142, is preferable for garden culture to any of the others, except in more northern sections of the country; then the oblique arm is the best.

Circumstances, however, will often occur, when it will be necessary to deviate somewhat from any of the plans given, to better suit the particular location in which we are obliged to plant. These variations may be innumerable; still, if no fundamental principle is interfered with, success is just as certain as though the plans laid down were strictly followed. For instance, we have endeavored to show that vines are more productive and yield better fruit when trained horizontally than perpendicularly; but it will make very little difference whether the arms are three feet long or thirty, provided they are not extended too far in any one season.

Neither does it matter whether the arms start from one foot above the ground or at ten, so far as principle is concerned; but when it is desirable to produce arms at a great

height, we must do it gradually, and not endeavor to accomplish it in one season. In the vineyard, the best possible position for the arms may be one foot from the ground, while in a garden surrounded by high walls, ten feet might be far better than any point below it.

It is therefore impossible to give a plan that will suit every position; but the horizontal arm should be the main point aimed at, whether it be long or short, high or low. The vines may also be trained with only one arm instead of two.

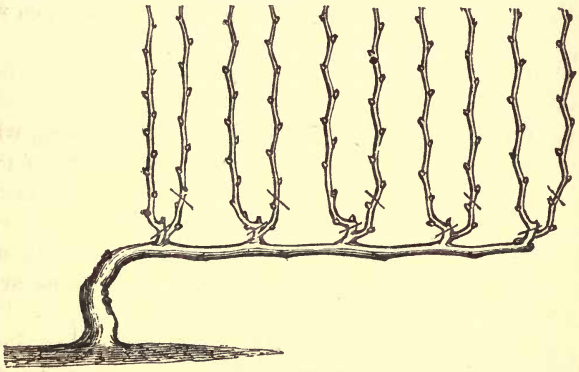

Fig 57.

Fig. 57 shows a vine with one arm having only five spurs, but it may be extended by bending down the right-hand upright cane, and in this manner the arm may be lengthened as required. The season previous to extending the arm, the end cane should be allowed to grow four or five feet long, instead of stopping it at the usual height, so as to have a strong cane to lay down. Three to four feet is about as much as should be added to the arm in one season, for if a cane of more than four feet is laid down, some of the buds will often fail to grow.

The vine may be planted, if need be, several feet from where we wish to train it, and the arm be allowed to extend that distance without producing upright canes, as it

will make no difference in the result whether the sap flows through one or ten feet before it reaches the leaves.

FOUR TIERS OF ARMS.

Sometimes it is desirable to fill a certain space which is higher than would be occupied by two tiers of arms; if so, plant the vines only two feet apart instead of four, and form four tiers in the same way as we formed the two tiers. Or two tiers of arms may be formed from one vine, although it will take a year or two longer than it would to plant more vines, and only take two arms from each one.

Fig. 58 is a very correct representation of an old Hartford Prolific vine, with two tiers of arms from the same vine. The arms are eight feet long, so that the vine covers a space sixteen feet long and only six feet high. There are ten spurs upon each arm, making forty in all, giving eighty upright bearing canes, and it is allowed to bear from two hundred and fifty to three hundred bunches annually. Last season it produced two hundred and fifty-six bunches.

I have introduced this vine here for two purposes: first, to show how an old vine that has been grown without any system of training may be brought into a good form; and second, that I may more thoroughly impress upon the mind of the reader the importance of training vines with horizontal arms, for the purpose of improving the quality of fruit as well as controlling the growth of the vine. Having an old Hartford Prolific vine in my garden, the fruit of which could usually be shaken off so soon as ripe, I thought I would try and see if the arm and spur system would have any effect upon it, and in any degree remedy this defect.

It is now as shown in the engraving, and the fruit has not only improved in size and flavor, but it adheres so well to the stem, that I have kept it for two months after picking, and still the berries would not fall from the bunch if

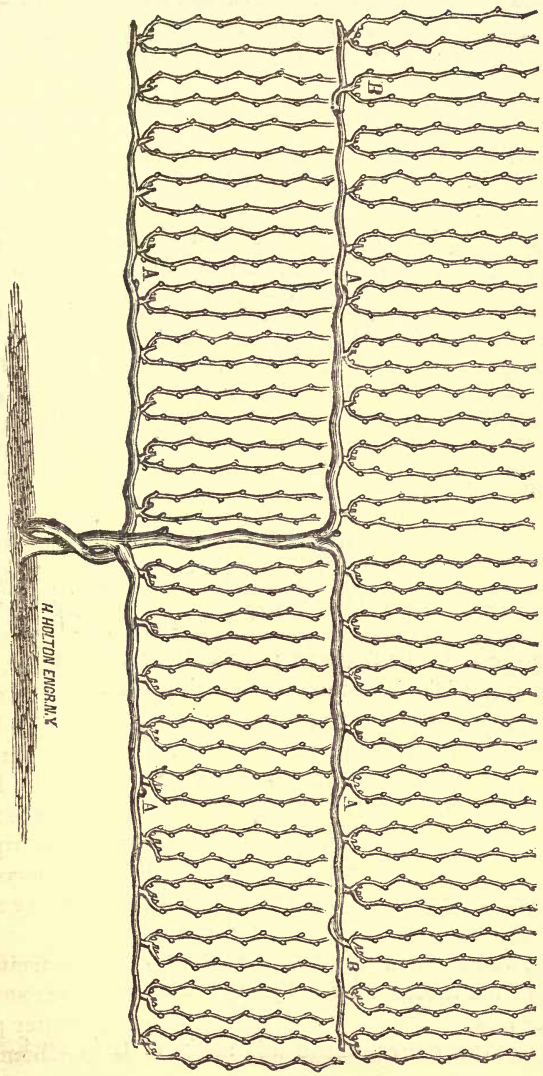

Fig. 58.

handled carefully. It is now five years since the vine was trained in this manner, and the fruit seems to improve instead of deteriorating. I do not attribute the improvement in the fruit entirely to the horizontal arms, but only in part, for without doubt the spur-pruning and the close pinching of the young shoots assist very much in the development of the fruit. The method used to obtain these arms was as follows:

The season before I attempted to train it, I cut the whole vine back to within about three feet of the ground, and let it produce new shoots from whatever part they happened to come. It being an old untrained vine, as I have stated, it produced several very strong young canes, and I cut away all but four; the two upper ones started about three feet from the ground, these I cut off to four feet and laid them down horizontally; they reached to A, A. One of the two lower canes sprung from the old stem about one foot from the ground, and just where it was wanted for the lower arm, but there was no young cane opposite to form the other. There was, however, one that came out from near the roots, and this was used for the other lower arm by twisting it around behind the old stem, and bringing it down opposite the first arm; the two arms were then cut off at A, A. The lower arms are trained on the same level, although one of them starts a foot or more below the other. This makes no difference except in appearance, as it does not matter whether the arms start from buds nearly opposite or not; all that is requisite is to bring them to nearly the same height before they are allowed to produce leaves or fruit. The next season the two end canes were allowed to grow long enough to lay down and extend the arms to their full length. In selecting the buds for upright canes I reserved some of those on the under side of the arm; the canes from these bear fruit just as well as those from the upper side.

I would not recommend this mode of training for vine-

yard or garden, except in cases like the above, where it is desirable to bring an old strong vine into the arm system. Vines that have been trained with only two arms may, after they become old, be allowed to produce an extra tier, but the sap will usually flow with greater force into the upper arms, and necessitate the checking of the canes on them sooner than on the lower ones. To produce a second tier of arms upon a vine having only one tier, the bearing cane nearest the center is allowed to remain at the time of the annual pruning, and the end cut off at the point where it is desirable to have the arms start. The next season the upper two buds on it are allowed to grow for the arms, and the following season they are laid down for a second tier.

DOUBLE STEM.

A few years since I had some vines growing in a border on the south side of a wall. They started so early that

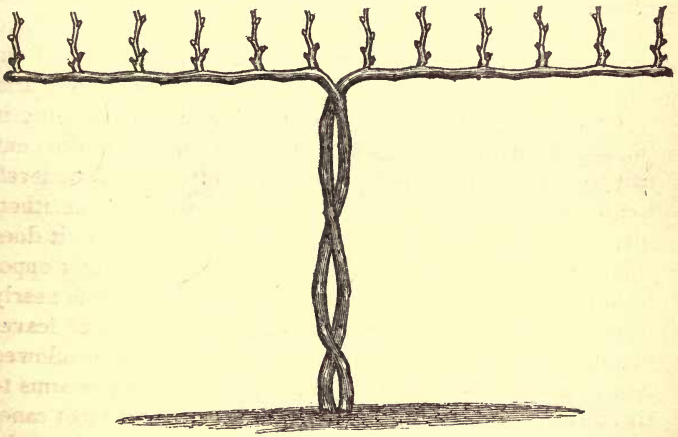

Fig. 59.

most of the young shoots were cut off by a late frost; consequently the buds which I had selected for arms were destroyed. The vines being young, new shoots started

from below the ground. I cut away all the old stem, and selected two of the strongest shoots that came up, and cut off the others. These two shoots were kept tied to a stake during the season, the laterals pinched, etc. The next spring the two canes were laid down for arms; those for the upper tier were twisted around each other, and then laid down and fastened to the middle bar.

Fig. 59 shows one of these vines at the present time. Accidents will often happen in vineyards as well as in gardens, rendering it necessary to have recourse to some such plan to restore lost arms without loss of time. This is perfectly practicable, and the final result will be as satisfactory as though there had been no interference with the plan laid down at the beginning. Many other variations from the usual course of proceeding might be given, but I have mentioned enough to show that a general principle may be taken as a guide in grape culture, and still be varied to suit the different circumstances attending it.

TRELLISES IN GARDENS.

The same form of trellis described for the vineyard may be used in the garden, varying it in length, height, etc., to suit the position in which it is placed, as well as to meet the wants of any particular vine. The trellis is indispensable, as the vines should never be fastened directly on the side of a building or fence, but should be at least six inches from them; a foot is still better, as this allows a free circulation of air behind the vine, and prevents, in a great measure, the burning of the leaves, which usually occurs when vines are laid against the boards or wall. Besides, the surface on which the vine is trained will soon become defaced by the constant rubbing of the leaves against it, while the accumulation of dust and moisture will cause the rapid decay of the boards; and even a stone or brick wall will be injured more or less by having vines trained against

it. If the trellis is suspended by iron or wooden brackets, no apparent injury will be done to the surface behind it.

TRAINING TO STAKES.

There is seldom a garden so small but there is room for at least one grape vine, though it is often the case that there is a place for a vine but no room for a trellis; when this occurs, the vines may be trained to a stake, or a number of them; and when so trained they may be planted among shrubbery, in flower beds, or upon the lawn. There is nothing that will add more to the beauty of the garden, or produce a better effect than vines, planted in groups or scattered here and there, as is usual with ornamental shrubs and plants. The vines in such situations should always be kept low and never permitted to produce long and naked stems which would become unsightly and mar the beauty of the garden when they become old. Prepare the soil as for vines in other situations, and grow but one cane the first season; then prune it down to eighteen or twenty-four inches from the ground; the next season allow but two canes to grow; pinch off the tops of these when they have grown five or six feet, so that they shall not only ripen their wood but become more stocky. Fig. 60 shows the vine with two canes at the end of the second season. If the vine was large and vigorous when planted it will usually produce fruit the second season; if so, pinch off the top of each cane when it has grown about two feet; this will

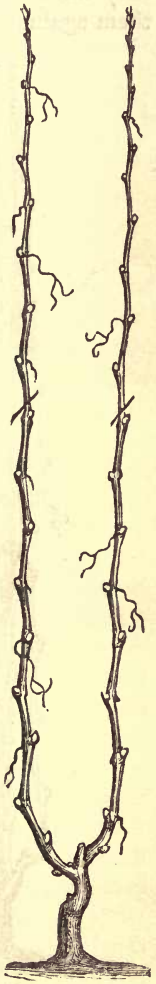

Fig. 60.

assist the development of the lower leaves, which are so important to the proper development of the fruit. When they have started and grown a foot or two more, stop them again; they will usually need checking several times during the season. The canes should be neatly tied to a stake, and the laterals may be allowed to grow a foot or more before being checked, as they assist in hiding the stake, and their own weight causes them to slightly droop, giving a more pleasing effect than when all is kept tied close; for when vines are grown in a flower garden we endeavor to combine the ornamental and useful. The third year the vine with two canes should be cut back to two buds each. From these buds we produce four shoots, each of which will usually bear three to five bunches of fruit, so that we have from twelve to twenty bunches on the vine. Fig. 61 shows the vine with four canes as it will be at the end of the third season.

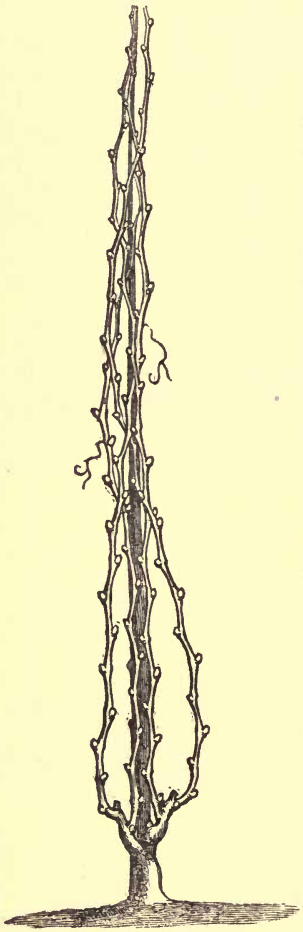

Fig. 61.

The vine may now be pruned in the same manner as before; that is, each cane is cut down to two buds, and eight canes be allowed to grow the fourth year; or two may be cut entirely away and leave but two

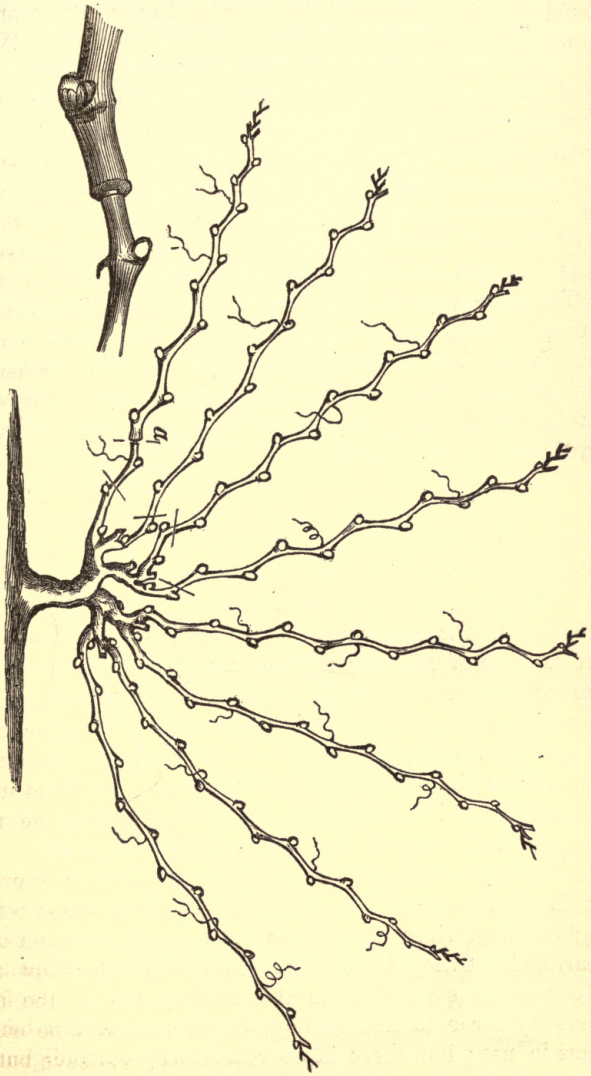

Fig. 62.

buds on the others. If eight canes are produced, they will require one additional stake or a trellis, so that they may be spread out and give a better opportunity for growth. Fig. 62 shows the vine with eight canes as it appears when trained on a trellis. This vine may be again pruned in the same manner, and twelve or sixteen canes allowed to grow; and this is essentially the same system practiced in some of the vineyards at the present time, and it answers very well if a portion of the canes are cut away each year, so that they will not become too much crowded.

The system when carried to the extent of thirty to forty canes becomes quite complicated, and it is difficult to distribute the fruit so widely and evenly as when the vine is trained with arms. But when the vines are grown in small gardens, four or six canes are as many as should be allowed on those trained to stakes.

There is no difficulty in keeping the vines within a small space, and with the main stem only a foot or two high. All that is necessary is to keep the young growth checked during the summer, and when pruning the vine, leave only those buds which are required to produce fruiting canes.

I test all the new varieties in this way, never going to the expense of erecting trellises for them until they have proved themselves worthy of it. The vines will remain just as healthy when grown in this manner as when allowed to spread over a space of fifty or one hundred feet. I am well aware that *theorists* assert that the vine must have room to expand and extend its branches as it grows old; but one fact is worth any number of theories, and there are thousands of vines in Europe that are from fifty to one hundred years old, the main stems of which are not two feet high. These vines are pruned back to the stump every year, and yet they live and bear fruit of the best quality. We have no such vines in this country, nor is there any necessity for ever having any, because there are better plans in use; but there is no reason why our indigenous

varieties may not be dwarfed as well as the European kinds. Fig. 63 shows one of the old vines of Europe. This vine represents what is termed "head-pruning;" the

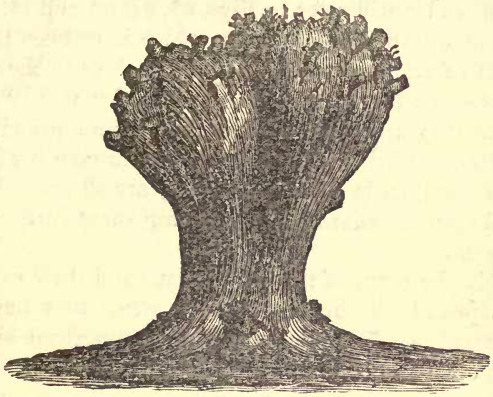

Fig. 63.

vine being pruned in close to the stump every year, and the accessory buds are mainly depended upon for producing the bearing canes.

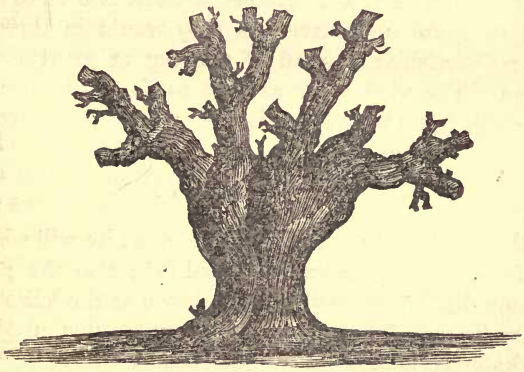

Fig. 64.

Fig. 64 shows another form, which is called "buck pruning." The head is allowed to divide into several parts,

thereby allowing it to produce more fruit than upon those that are pruned to one head. This is an old Hungarian mode, and it is still practiced in many parts of Europe.

If the reader will refer to Figs. 63, 64, 62, and 45, he can see at a glance the improvements which have been made in the form of training the vine from the days of the ancient Romans down to the present time. And it will be readily seen that they are all founded upon the same principle, the only difference being that the top of the vine is extended more in one than in the other. They are all pruned on the renewal system—that is, all the young shoots are cut back every year.

Within the range of these four plans and their variations are comprised all the successful systems that have ever been invented. The head pruning is practiced upon the poorest of soils, and the buck pruning on soils that are only moderately rich, and the other two upon rich soils, and with the strongest growing varieties.

There is, however, a system of training in use in Lombardy that differs from any of those given; but it should not be called an artificial system, because the vines are allowed to grow upon trees, as they would in their wild state, no particular method of training or pruning being adopted. The vines bear as well as they would in their wild state, but the process is a slow and tedious one at best.

GIRDLING THE VINE.

If the reader will turn back to Fig. 62 he will see that one of the canes is shown as girdled (A); also the part of the same that has been girdled is shown at the left and below the figure. This operation, though often producing remarkable results, is still of questionable utility.

That it causes the fruit to grow much beyond its natural size is certain, but the quality is never improved, and usually very much injured. The practical results of such

an operation seem to be, to cause the fruit to assume the appearance of ripeness much earlier than it would otherwise, and become so much increased in size as often to take the prizes at horticultural shows, where the judges are often influenced by appearance instead of quality. Many a *dropsical* cluster of grapes has been awarded a premium over the rich well-ripened cluster of the same variety, merely because it had a fine appearance.

The girdling may be done at any time in the spring after the vine starts, up to the time the fruit is fully grown. But unless it is done several weeks before the fruit commences to ripen, it will have but little effect. The best time to perform the operation is just before or soon after the fruit is set. The mode of operation is as follows: cut away a ring of the bark, from one fourth to one half inch wide, clear to the true wood. It may be performed on old wood, or upon the young canes when they have made a foot or two of growth, but the last year's wood is preferable, and it should be done only on that which you intend to prune away.

The incision is always made below the bunch which it is desired to affect. The bunches above the incision become much larger than those below it; this is said to be caused by the obstruction of the downward flow of the sap to the roots.

The practice of girdling the vine for the purpose of affecting the fruit is supposed to have been invented about 1745, by Col. Buchatt, of Metz, in France. For this he was awarded a premium by the Agricultural Society of France. It was claimed that the invention would be of great value in hastening the maturity of the grape, as well as improving the quality; but it is doubtful if either of these results has been obtained in its practice.

REMOVING THE LEAVES.

There are many persons, in cities especially, who are in the habit of removing a portion of the leaves from their grape vines just before the fruit begins to ripen, for the purpose, as they say, of hastening it. This is perhaps one of the most absurd ideas that could be possibly entertained, as the grape ripens better in the shade than when exposed to the sun; besides, the ripening process is conducted almost entirely by the leaves, the grape being one of those fruits that must be ripened on the vine or not at all; and if it is picked before ripe, the process is immediately stopped, there being no further improvement in flavor. If the leaves near the fruit are taken off, ripening is not only checked, but often entirely stopped.

The fruit that is exposed to the direct rays of the sun after the leaves have been taken away, may change its color, but it seldom ripens. It is not only necessary that there should be good healthy leaves on the fruiting cane, but they should be near the fruit. Every one who has seen grapes upon the vine must have observed that there is always a leaf opposite to every bunch of fruit; that this leaf is of great importance to that particular bunch is certain. In Fig. 65 the connection between the two is shown; *a* is a portion of the stem of a bunch of fruit; *c* is the leaf-stalk; the pith is shown in the center, being the broad dark line running lengthwise of the cane; this occupies more than one third of its di-

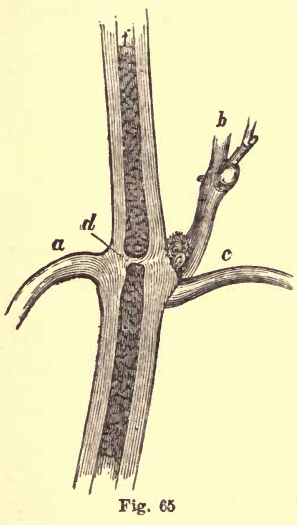

Fig. 65

ameter, but is divided at *d* by wood which unites the two sides of the stem. Now whether the sap crosses directly through the young cane from leaf to fruit, or around the pith, is not positively known, but that there is a connection between them by which the fruit is benefited, can be readily demonstrated by removing the leaf early in the season. When this is done, the fruit is not so perfect as when it remains.

This imperfection is not altogether owing to the loss of shade which the leaf afforded, because if the same amount of shade is given the fruit artificially, it is still more or less affected. If the lateral (*b*) remains with a leaf or two upon it, the injury to the fruit is not so marked, because its leaves perform, in part, the functions of the one removed. One great object in pinching off the end of the growing canes is to cause the leaves to grow larger, thicker, and better able to assist in perfecting the fruit; therefore the main leaves on the stem should never be removed, and especially let those that are near or opposite the fruit be carefully preserved.

CHAPTER XVII.

MISCELLANEOUS.

THINNING THE FRUIT.—There are very few varieties of grapes, cultivated in the open air, that require the thinning out of the fruit to enable them to ripen. Most of the native varieties have bunches sufficiently open and loose to allow the air to circulate freely among the berries and aid them in ripening. If a portion of the berries are removed, those remaining will certainly grow much larger than if all were allowed to mature. There are some varieties that have naturally very compact bunches, so much so that all of the berries will seldom ripen unless a portion of them are removed. With such as these it is best to cut out a part of the berries so soon as they are fully formed. This thinning should be done with a pair of sharp-pointed scissors, cutting out from one fourth to one half the berries, taking them from different parts of the bunch, so that when it is fully grown it will be uniform, and the berries will not be any more crowded upon one part than another.

It would scarcely be practicable to thin out the berries of all the bunches in a vineyard, and no one would think of cultivating extensively a variety that required it; still, there are varieties which are highly recommended by some persons, that will seldom mature more than half the fruit that sets. The bunches of these should be thinned.

These varieties often possess valuable qualities, and if persons have time to give them the requisite care, really excellent fruit may be obtained. There is scarcely a better or more beautiful grape than the Herbemont, when it is grown in a warm, protected situation and its fruit prop-

erly thinned, and there is none more worthless if an opposite course is pursued.

The compactness of the bunch is often variable with the same variety in different localities; in one the berries may be very much crowded, and in another comparatively loose. In the former case the berries will not only be much smaller, but they will often burst open, especially if they have a very thin skin.

Those varieties that produce very compact bunches are always benefited (in appearance at least) by thinning the berries, and those who are growing such with the expectation of making show bunches, should not neglect this operation.

Sometimes it may be beneficial to remove whole bunches, but when the vines are properly pruned and trained, this will seldom be necessary.

GATHERING THE FRUIT.

Grapes are usually gathered long before they are *really* ripe. Sometimes this is done for the purpose of getting them into market early; in other cases it may be because they *appear* to be ripe, when, in fact, the ripening process has only commenced. Nearly all varieties change their color fifteen to twenty days before they are fully matured; and as the grape is one of those fruits that must ripen before being gathered, or not at all, it must be apparent that too much care is not likely to be given upon this point.

It is natural to be impatient for the harvest, particularly when we have waited so long, and watched with so much care and anxiety for the ripening of our fruit; still, a little haste may be more fatal than considerable delay; for grapes that are over-ripe keep much better than those that are not *fully* ripe. The stem of the bunch will usually turn brown and become somewhat shriveled when the fruit is fully matured.

Always gather the grapes in fair weather, and wait until the dew has dried off before commencing in the morning. Cut off the clusters with a knife or shears, and handle them with care, so that the bloom shall not be rubbed off nor any of the berries broken.

If any portion of the crop is not ripe, leave it on the vines and gather it separately, after the best has been secured, provided it is worth the trouble. If there be any unripe or diseased berries in the bunch they should be taken out at the time of gathering.

PRESERVING THE FRUIT.

To many persons the preservation of fruit in its natural condition is second only in importance to that of producing it. If we can, by any simple means, keep our grapes fresh two or three months, it not only prolongs the period of enjoyment of a luxury, but if it be desired to sell the fruit, the price will be found to increase as the season advances, beyond the usual marketing period, the earliest and latest in market always commanding the highest prices, although not always the most ready sale.

There is no reason why the tables of those who desire grapes should not be supplied with them for four or five months in the year. Every variety of grapes will not keep well, any more than every sort of apples or pears; still, a majority of the grapes now grown will keep several months with ordinary care.

The process of preserving is very simple, and requires more common sense than science. The requisites are: 1st. The fruit should be thoroughly ripe, should not be bruised or broken, but carefully handled while gathering and packing. The fruit may be put away on shelves, or packed in small boxes; the latter method is probably the best, as it is more liable to become shriveled when left in an open room than when confined in a smaller space. Boxes that

will hold from twenty to thirty pounds are of convenient size, and the fruit will retain its flavor much better with twenty pounds in a box than when there are only five pounds. The boxes should be made so that they can be shut tight; if there should be need of ventilation, it can be given by opening the box, but constant ventilation of them is only another name for continual evaporation, which would cause the fruit to shrivel and thus destroy its value.

A cool and steady temperature should be maintained, and if it could be kept between 35° and 40° there would be but very little trouble in keeping the fruit, even if but little care were given to the packing. Very few persons have a room or cellar that can be kept so cool as 40°; consequently more care is necessary in gathering, packing, etc.

A warm, *damp* atmosphere is very injurious, as it will soon cause the grapes to rot; but the presence of considerable moisture will do no harm, provided the temperature is low.

There are various materials used in packing grapes, many of which are good, while others are positively injurious. Saw-dust is used in packing the Malaga grapes which are so common in our markets; but the flavor of the grapes is always injured more or less by it, giving them a strong woody taste. Cork-dust is far better than common saw-dust; but it can not be obtained except near cork manufactories, and perhaps not then to any amount. If any such material is to be used, there is none better or more easily procured than chaff of rye, wheat, or oats Rice chaff would probably be still better.

When the grapes are gathered, bring them into a cool room and spread them out upon a table or shelves, and let them remain there for a few days until all surplus moisture has passed off; then pack them away in the boxes, as follows: spread a thick sheet of paper on the bottom, then lay on a layer of bunches, placing them close together; then another sheet of paper, and so on until the box is full.

Boxes deep enough to hold four or five layers are better than deeper ones. When the boxes are filled, put them away in a cool place, and where they can be examined occasionally, and the decayed berries be taken out from time to time as they appear. If the place is cool and the fruit sound and ripe, they will keep three or four months without further care.

WINE MAKING.

The making of wine is supposed by many to be necessarily connected with grape culture. So general has been this belief that nearly every book upon this subject has its chapter upon wine making, whether the author knew anything about the subject or not. For my own part, I could never understand why wine making had anything more to do with grape culture than whisky or starch making had to do with corn growing, or cider making and the production of apple jack should necessarily be recognized as a part of pomology. Two hundred years ago, when John Evelyn wrote his "Pomona," it would not have been thought complete without those wonderful chapters on "The Making and Ordering of Cyder!" The man who writes a book on apple and pear culture, at the present time, would hardly think it in his line to tell how to make perry and cider, nor would it be expected of him. I shall therefore depart from the general rule, and for two reasons: 1st. I believe that wine and brandy making do not necessarily belong to grape culture. 2d. I should not be able to give any information from actual experience; and I believe the reader will agree with me that in horticulture, at least, none have a right to become teachers until they have themselves been scholars.

There are plenty of men in our country who know how to make wine, and from them we should get correct information upon the subject, provided they can be persuaded

to give it, and none others should be heeded. It is not every one who attempts to make wine that accomplishes it; for every vineyardist does not know how to make wine any more than every wine maker knows how to grow grapes.

Let us first supply the country with good table grapes; then, if there should be a surplus, we can call on the wine, vinegar, and brandy maker for information and assistance in disposing of it to advantage.

PRUNING SHEARS.

Those who have a large number of vines to prune know the importance of having a good implement with which to do it. With a first-rate pair of shears a man can prune many more vines in a day than he can with a knife; besides, there is less danger of breaking off those buds which it is desirable to retain. In pruning fruit trees the pruning-knife is preferable, because we usually wish to make a smooth cut, so that the wound will heal over; not so with the vine, as the cut is generally made between the buds, and the wound is not expected to heal; the stump above the bud dies back to it, and if this is cut away it is only for looks—nothing more. Therefore in pruning vines it is not requisite to leave a very smooth surface to the wounds, though to have an instrument that will cut smooth and easy is very desirable.

There are any number of styles of pruning shears—German, French, English, and American. Some are good, but more that are good for nothing. The best shears that I have ever used (and they are not a few) are those made in this country. I am not aware that they have any particular name, but "J. Wiss, Newark, N. J.," is stamped on the blade, and I presume that to be the name of the manufacturer. Fig. 66 shows the shape of these shears. The springs are of brass or of some similar composition which

seems not to be affected by cold, as I have frequently used them when the thermometer was at zero. Steel springs I have found were very liable to break in frosty weather.

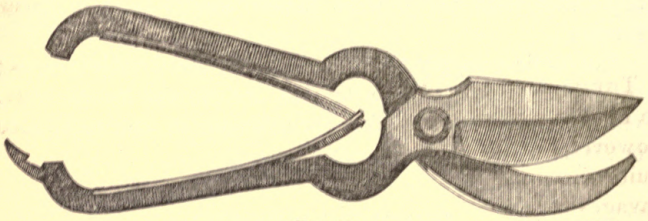

Fig. 66

There is a catch at the ends of the handles to fasten them together, so that they may be carried safely in the pocket. In the engraving the catch is shown as open, but it may be turned in against the spring, so as to be out of the way when the shears are in use. There are several sizes of these shears, and the price formerly was from $1 00 to $1 50; at present they are a trifle higher. I presume they can be had at most of the seed stores in New York.

CHAPTER XVIII.

INSECTS.

THERE are few of our cultivated fruits that are less liable to be infested by insects than the grape; it has its enemies, however, which, if allowed to increase, would soon become quite formidable. In some parts of the country insect ravages have been so great that it has materially checked the cultivation of the vine.

The rapid increase of insects is, without doubt, owing in a great measure to the destruction of those birds that live mostly upon them. If we destroy or drive away the natural enemies of the insects, then we must take upon ourselves the office of destroyer, and work with perseverance and vigilance, or see all our efforts to produce fruit in abundance of no avail. That noxious insects are rapidly increasing throughout the country must be apparent to every one who has given the subject attention. Insects that ten years since were unknown in the Western States, are now found there in abundance, having been introduced, not only from the Eastern States, but imported from European countries with seeds, fruits, etc.

It matters but little where these hosts of insects come from, the fact that they exist, with few idlers among them, is enough to set every one of us to work to check their progress in every way possible. To proceed on our work of destruction understandingly, we should first know our enemies, for some insects that are found on the grape vine do not injure it, but assist us in destroying those that are injurious, therefore an indiscriminate slaughter, in many cases, would be very injudicious. There are many nostrums offered at the present time which are said to be insect remedies, and doubtless a few of them are really what

they purport to be, as some are easily destroyed by very simple means, but there is no universal remedy the application of which is at all practicable. A material that would act as a poison upon one might serve as a food for another, while it would be very difficult to find anything so powerful that it would kill all kinds of insects, and at the same time not injure the plants upon which they were found.

The following list is not supposed to contain all, or any considerable portion of the insects that are injurious to the grape, but only those that are best known.

There are often several species nearly related to each other, and from a description of one of the number the others may be readily recognized. Every vine-yardist should make himself acquainted with the various insects that infest the vine, and thereby be enabled to more successfully check their ravages.

There are several excellent works on entomology that are within the reach of those who desire information on this subject; the best among them is Harris' "Insects Injurious to Vegetation," a new edition of which has lately been issued by Crosby & Nichols, Boston—edited by Charles L. Flint. To this work I am mainly indebted for many of the illustrations and descriptions I have given.

ROSE CHAFER, or Rose Bug.—*Melolontha subspinosa*,

Fig. 67.

—Fig. 67—of Fabricus, by whom it was first described; it belongs to the modern genus *Macrodactylus* of Latreille.

This beetle measures seven twentieths of an inch in length. Its body is slender, tapers before and behind, and is entirely covered with very short and close ashen-yellow down; the thorax is long and narrow, angularly widened in the middle of each side, which suggested the name *subspinosa*, or somewhat spined; the legs are slender, and of a pale red color; the joints of the feet are tipped with

black, and very long. This is one of the most common and destructive insects known to infest the grape in this country. In some parts of the Eastern States it makes its appearance in such vast numbers that it is impossible to stay its ravages. It does not seem to be at all fastidious in regard to its food, as it feeds indiscriminately upon nearly all kinds of plants. If it has a choice it is not a very particular one, as I have found it feeding upon the flowers of the cherry, grape, ox-eye, daisy, sumac, rose, and upon all the different species and varieties of the spiræa; and when the flowers of these are gone it will attack the leaves. I had one season about a hundred cherry trees entirely stripped of their leaves by this voracious little pest. It prefers, however, the flowers of plants to their leaves, and it usually makes its appearance in the spring, about the time the grape comes into bloom. It eats the flower with avidity, and when it appears in large numbers they make short work of the entire crop.

There are a number of remedies recommended for the Rose Chafer, but I know of none better or more effectual than that of catching them by hand and killing them. They can be caught very rapidly by taking a large cup or basin, with a little water in it, and holding it under the insect; giving the cluster of flowers a slight jar, the bugs will immediately let go their hold and fall into the dish. When a quantity have been caught, throw them into the fire or pour hot water upon them. I have followed this simple plan for several years, and though I have not been able to annihilate them, their numbers have not increased.

If a whole neighborhood would band together, each destroying all to be found upon his own place, there would be a prospect of soon exterminating this most destructive enemy of the grape. There is no other way of destroying them than to attack the insect itself, because the female deposits its eggs in the ground where they can not be reached by any ordinary means.

GRAPE VINE FLEA BEETLE.—*Haltica chalybea*,

Fig. 68.

—of Illiger, Fig. 68, is a somewhat magnified representation of a beetle which is found in almost all parts of the United States, on wild and cultivated grape vines. Although this beetle has received the specific name of *chalybea*, meaning steel-blue, it is exceedingly variable in color. "The most common tint of the upper side is a glossy, deep, greenish-blue, the under side is dark-green, and the antennæ and feet are dull black. The body is oblong oval, and the hinder part of the thorax is marked with a transverse furrow. It measures rather more than three twentieths of an inch in length."

Two broods usually appear in a season—the first in April or May, according to location, and the second in July and August. I have not heard of any section where they have been very destructive, but they will probably become so unless some precaution is taken against their farther advance. Hand picking is the surest mode of destroying them. It is said, however, that if a strong solution of potash is thrown over the vines it will destroy them. I have never been troubled with them to such an extent but that they could be easily gathered by hand, or shaken from the vines and crushed by the foot.

SPOTTED PELIDNOTA.—*Pelidnota punctata.*

Fig. 69.

Fig. 69. This beetle is found upon the grape vine in the months of July and August. "It is of an oblong oval shape, and about an inch long. The wing-covers are tile-colored, or dull, brownish yellow, with three distinct black dots on each; the thorax is darker and slightly bronzed, with a black dot on each side; the body beneath

and the legs are of a deep, bronzed, green color;" Mr. Harris also adds, "that their only food is the leaves of the grape." The *Pelidnota* is of such a large size, that should its numbers ever become great, it would be very destructive. I have never found more than half a dozen upon any one vine, and these were easily picked off and killed.

TREE BEETLE.—*Areoda lanigera.*

This beetle is found mostly upon trees, such as the pear, oak, hickory, etc.; but having in several instances found it feeding upon the leaves of the grape vine, I have inserted an illustration (Fig. 70) and a description, so that the attention of the vineyardist might be called to it in case its numbers should become so great as to render its destruction necessary.

Fig. 70.

It is about nine tenths of an inch in length, broad oval in shape, of a lemon color above, glittering like burnished gold on the top of the head and thorax; the under side of the body is copper colored, and thickly covered with whitish wool; and the legs are brownish yellow or brassy, shaded with green. They appear in this vicinity in June. Harris states that the larva of this insect is not known.

CATERPILLARS.

Caterpillars are the larvæ of butterflies or moths. These insects have four stages of existence: the egg, caterpillar, pupa or chrysalis, and the perfect insect. Of these it is the caterpillar alone which is troublesome; they feed upon the leaves of plants and are often very destructive, especially in city gardens. In certain groups the caterpillar becomes, in its winged state, a butterfly, and in others a moth. The former fly by day and the latter by night, or toward evening only. They are also distinguished by peculiarities of

structure not necessary to mention here. The numerous species are recognized by the entomologist by peculiarities of form, color, structure of legs and antennae, and numerous other characters which enable him to classify them into genera and families.

YELLOW BEAR.

The caterpillar called by Harris the Yellow Bear (Fig. 71) is a very destructive individual, which does not confine itself to the grape vine, but feeds upon almost every

Fig. 71.

kind of plant to be found in the garden. This kind of caterpillar varies very much in color; it is perhaps most often of a pale yellow, or straw color, with a black line along each side of the body, and a transverse line of the same color between each of the segments or rings, and is covered with long, pale, yellow hairs.

Others are often seen of a rusty or brownish yellow color, with the same black lines on the sides and between the rings, and they are clothed with foxy red or light brown hairs. The head and ends of the feet are ochre yellow, and the under side of the body is blackish in all the varieties.

They make their appearance about the first of June, and continue during almost the entire summer. When full grown they spin their cocoons and remain in the chrysalis state until spring, at which time the moth appears.

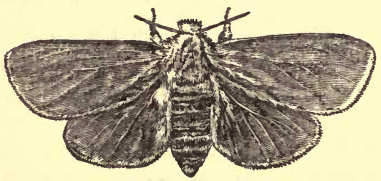

Fig. 72.

The Moth (Fig. 72) is known as the White

Miller—its scientific name is *Arctia Virginica.* "It is white, with a black point on the middle of the fore wings, and two black dots on the hind wings, one on the middle and the other near the posterior angle, much more distinct on the under than on the upper side; there is a row of black dots on the top of the back, another on each side, and between these a longitudinal deep yellow stripe; the hips and thighs of the fore legs are also ochre yellow. It expands from one inch and a half to two inches. Its eggs are of a golden yellow color, and are laid in patches upon the leaves of plants.

HOG CATERPILLAR.—*Chærocampa Pampinatrix.*

Fig. 73 shows this caterpillar covered with cocoons of a parasitic insect that lays its eggs upon it. When these eggs hatch, the larvæ from them feed upon the caterpillar and usually kill it.

Fig. 73.

Fig. 74 shows the parasite's natural size, also one that is highly magnified. The caterpillar is usually most abundant about midsummer, and when fully grown it descends to the ground, conceals itself under fallen leaves, which it draws together by a few threads, so as to form a kind of cocoon, or covers itself with grains of earth and rubbish in the same way, and under this imperfect cover it changes to a pupa or chrysalis (Fig. 75), and finally appears in the winged state in the month of July of the following year. The moth expands from two and a half to three inches, is of an olive gray color, except the hind wings, which are rust-colored, and the fore wings and shoulder covers are transverse, with

Fig. 74.

Fig. 75.

olive-green bands. It is said that the name *Pampinatrix* was given to the moth because it lived upon the young shoots of the vine; I think this must be a mistake. Sir James Edward Smith, who, Mr. Harris says, named this species, probably referred to the caterpillar, and intended the name to be applied to the genus instead of the species, as there are quite a number of these caterpillars which feed almost exclusively upon the vine. The word *Pampinatrix* was probably taken from *pampinatio*, the Latin for pulling off a tender vine shoot. The Romans used the term *pampinating* for what we call summer pruning, or pinching off the ends of the young shoots. See Columella and other ancient works on agriculture.

GRAPE VINE SPHINX.

Among the sphinges we have some of the most voracious of all the caterpillars. They are literally gluttons, as they never seem to stop eating from the time they are hatched until they pass into the chrysalis state. They are very destructive in a nursery of young vines, as a single caterpillar when nearly grown will, in twenty-four hours, eat every leaf on a one-stem vine of three or four feet high. The name *Philampelus* (lover of the vine) is very appropriate. The only way to get rid of these disgusting creatures is to pick or cut them off the vine, and destroy them by crushing or otherwise.

Fig. 76.

Those species that are mostly of a green color are not so readily found among the green leaves as others. The

larva of the *Philampelus Achemon* (Fig. 76) is one of the most common in this section of the country. There is another species which is much smaller, and of a brown

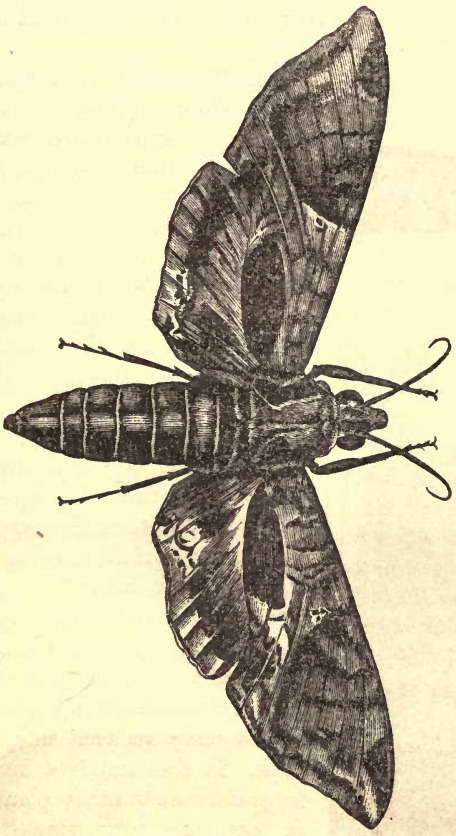

Fig. 77.

color, with pale yellow spots on its sides. This is quite common in cities, more so than in the country.

Another species of *Philampelus* which is quite small,

often infests old vines in great numbers. It not only devours the leaves, but seems to delight in cutting off the grapes from the bunches and letting them fall. The ground under the vines will often be covered with green grapes which have been cut loose by these little caterpillars.

The moths of some of the *Philampeli* are very beautiful, and on this account they are seldom destroyed; the largest expand their wings some four or five inches. Fig. 77 shows one of these moths, and Fig. 78 the pupa of the same. They are rather slow on the wing, their large bodies seem to be too heavy even for their large wings. They usually make their appearance in June. About the same time the moth of the *Attacus Cecropia* makes its appearance. It is very large, and the markings upon its wings are exceedingly delicate and beautiful. The caterpillar of which this moth is the parent is one of the largest of the garden. It often measures four inches in length, is of a pale green color, and is covered with large warts—those on the back near the head are red, the others are yellow, except one row, the whole length of the body on each side, which is blue. It does not feed on the vine in preference to other plants, but if it meets a young vine it is very likely to strip it before it passes on. When it obtains its full growth it retires to some shrub and there envelops itself in its cocoon. Fig. 79

Fig. 78.

Fig 79.

shows one of these fastened to a small branch. When the shrubs have lost their leaves the cocoons are readily found, and they should be carefully gathered and destroyed.

THE BLUE CATERPILLAR.

This caterpillar is quite common in almost all parts of the country; it is more than common in the vicinity of New York—it is abundant. It is described by Harris as a small blue caterpillar, transversely banded with deep orange across the middle of each ring, the bands being dotted with black, with head and feet also orange; the top of the eleventh ring somewhat bulging, and the fore part of the body hunched up when the creature is at rest. These caterpillars begin to appear about the middle of July, and others are hatched afterwards, as late, perhaps, as the middle of August. They eat all parts of the leaves, even to the midrib and stalks. When not eating they generally rest upon the under sides of the leaves. Fig. 80 shows the caterpillar as it appears when at rest. When fully grown it descends to the ground and buries itself three or four inches deep, and turns to a pupa without making a cocoon. In this vicinity the moths begin to come out of the ground about the first of June. Fig. 81 shows one of these moths; its name is *Eudryas grata*. Its fore wings are white above, with delicate marking of brown, olive green, and violet. The hind wings are yellow above and beneath, with a broad brown border behind. The upper side of the abdomen is yellow, with a row of black spots

Fig. 80.

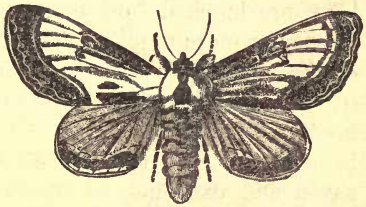

Fig. 81.

on the top, with another on each side. This is one of the most beautiful moths that appear in our gardens.

To destroy the caterpillars, hand picking is perhaps the only effectual way. This would appear to be an endless task, particularly when they come in such numbers as are sometimes found in cities. I would suggest dusting the vines with lime or wood ashes, or syringing them with a strong solution of potash and tobacco. Some such article might prove so offensive to the creatures that it would drive them away, if it did not kill them.

PROCRIS AMERICANA.

Fig. 82

Fig. 82. "This is a small moth of a blue-black color, with a saffron-colored collar and a notched tuft on the extremity of the body. The wings, which are very narrow, expand nearly one inch.

"The caterpillars are gregarious; that is, considerable numbers of them live and feed together, collected side by side on the same leaf, and only dispersed when they are about to make their cocoons. They are of a yellow color, with a transverse row of black, velvety tufts on each ring, and a few conspicuous hairs on each extremity of the body. They are hatched from eggs which are laid in clusters of twenty or more together, on the lower sides of the leaves of the grape vine and creeper; and they come to their growth from the middle to the end of August. They then measure six tenths, or rather more than one half of an inch in length. Their feet are sixteen in number and rather short, and their motions are sluggish. When touched, they curl their bodies sidewise and fall to the ground; or, more rarely, hang suspended from the leaves by a silken thread. When young, they eat only portions of the surface of the leaf; but as they grow older they devour all

but the stalk and principal veins, and passing from leaf to leaf thus strip whole branches of their foliage."

Fig. 83 shows a leaf as it appears with the caterpillars at work. The smaller ones have eaten out only the green portions of the leaf, leaving all the fine branching veins, while the larger ones have eaten all except the coarse,

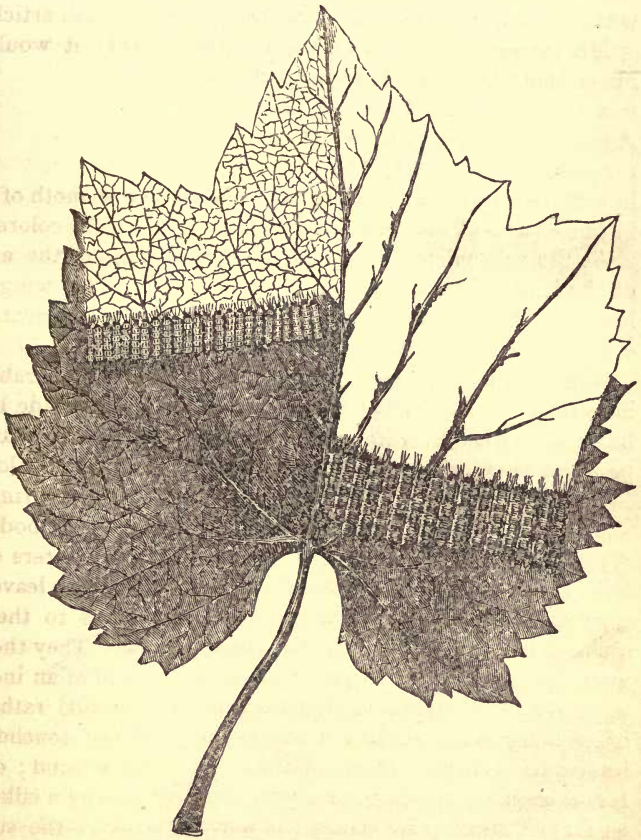

Fig. 83.—Larvæ of the Procris Americana feeding on the leaf.

woody portions. They always appear as if marshaled in a straight line, and move backward as they feed; and, like well-drilled soldiers, retire in good order.

They are not numerous in this vicinity—I have had but one vine attacked by them for the past two or three years; and though they could have been easily destroyed, I preferred to allow a few to remain each year, as I enjoyed watching these industrious little creatures.

Mr. Harris states that only one annual brood appears in Massachusetts. Two broods appeared here (in Brooklyn) last season. Prof. Townend Glover, Entomologist to the Agricultural Bureau at Washington, stated to me in a letter last summer (1863), that this insect was quite common in that vicinity, and had been very destructive to the grape in some parts of the South.

As the caterpillar feeds entirely upon the upper surface of the leaves, it can be readily destroyed by dusting the leaves with lime when wet with dew, or the leaves may be cut off with the insects upon them and thrown into the fire.

The canker or measuring worm is said to infest the vine in some sections, and the curculio is said to sting the fruit, but I have not met with either of these on the grape, and presume they have not infested it to any great extent.

LEAF ROLLERS.

The leaf rollers are a class of insects that are becoming very numerous in almost all parts of the country. There are several species found in our gardens, some of which are very destructive to the grape, as they commence feeding upon the buds so soon as they begin to swell in the spring, often being found within the half-expanded bud, eating out its entire center. They continue their work after the leaves expand, drawing the leaves together with their silken thread, forming for themselves a snug retreat; and literally, as some creatures of a higher order do figuratively,

eat up their own abode. The one that is most destructive to the grape in this vicinity is a small green caterpillar about one half inch long, and about one twentieth of an inch in diameter. This variety is also found in abundance on the rose. Mr. Harris named it the *Loxotænia Rosaceana*. The moth, Fig. 84, is described by him as follows: "The fore wings of this moth are very much arched on their outer edge, and curve in the contrary direction at the tip, like a little hook or short tail."

Fig. 84.

They are of a light cinnamon-brown color, crossed with little wavy darker brown lines, and with three broad oblique dark-brown bands, whereof one covers the base of the wing, and is oftentimes indistinct or wanted; the second crosses the middle of the wing; and the third, which is broad on the front edge and narrow behind, is near the outer hind margin of the wing. The hind wings are ochre yellow, with the folded part next to the body blackish. It expands an inch or a little more.

Whale-oil soap, diluted in water, is said to be destructive to these insects. It may kill the caterpillars provided it reaches them; but there is the difficulty, as they are rolled up within the leaf, where no liquid thrown over the vine will be likely to reach them. Picking them off and crushing has been my usual method of destroying them.

THRIPS.

These are very minute insects, scarce exceeding one sixteenth of an inch in length. They are usually of a pale greenish yellow color, or nearly white. They attack the under side of the leaves, and their presence is soon shown by the pale green or yellow spots which appear upon the upper side. The thrip seldom attacks the vine in the open air, confining itself mainly to those that are grown under

glass, or against a wall or building. Sometimes thrips will attack the fruit when it is nearly ripe, but usually they confine themselves to the leaves. Syringing the vines with a strong solution of tobacco water is one of the most effectual modes of getting rid of this little pest.

APHIS.

The Aphis, or green fly, often called plant-louse, is another very small insect, although much more injurious than the thrip. The rapidity with which they multiply is truly astonishing, as in a few hours after they make their appearance upon a plant it will often become entirely covered with them.

They usually attack only the ends of the young shoots and more tender leaves, feeding upon the juices of the plant, which they take from it in such quantities as to cause those parts which they infest to soon wither and die. Moist, warm weather seems to suit them better than any other. They frequently attack young vines in the nursery, and often entirely destroy the terminal shoot as well as the young laterals, thus severely checking the growth of the vine.

Vines grown under glass are more subject to the attacks of the aphis than others, but here they are readily destroyed. Fumigation with tobacco smoke is the most effectual remedy. The process is as follows: first syringe the plants until every leaf is wet, or at least damp; then take a wire basket or small furnace, and fill it with live coals and carry it into the house; throw some tobacco upon the coals and fill the house with smoke; shut up the house and let it remain for twelve hours, after which ventilate it and give the plants another good syringing so as to clean off the dead insects and smoke. Although the aphis is easily destroyed when infesting plants in the house, when they attack plants in the open air it is quite another thing.

Fumigating a nursery of young vines is out of the question; and syringing with tobacco water or any other material is entirely impracticable. The only effectual method that I have found is to go over the young vines and cut off the ends of the laterals that are infested and throw them into a basket, then take the terminal shoot in one hand, and with a good stiff brush clean off the aphis. A few upward strokes will usually kill every one, without materially injuring the young shoot. A good leather glove will be needed to protect the hand that holds the shoot. The generic name of this insect is *Aphis;* the specific name is usually taken from the name of the plant upon which it is found; thus, when found on the vine, it is called *Aphis vites;* when on the apple, *Aphis mali*, from *malus*, the specific botanical name of the apple.

The larvæ of a small spotted insect called the Lady Bird feeds upon the aphis, devouring vast numbers of them. The lady bird is the gardener's friend, and they should never be killed if it can be avoided. These little beetles are usually red or orange yellow, with small black spots; some kinds have only three spots, others have as many as nine. They are very common, and many has been the crime that has been laid to them of which they were entirely innocent.

RED SPIDER.

The Red Spider, *Acarus tellarius*, is one of the smallest insects that infest the vine. It is so very minute that it appears as only a small red speck, and can scarcely be seen by the naked eye. It usually confines itself to the under side of the leaf of vines in the house, though it will sometimes make its appearance on vines in small gardens and do considerable damage.

They spin a fine web over the under surface of the leaf as a kind of nest or protection; here they live in large numbers, and by puncturing the leaves for food, cause it to

turn to a sickly yellow color. The upper surface will show small light-colored spots soon after the spider commences its attacks on the under side.

A continued warm and moist atmosphere is death to the red spider; but while we were destroying him, the aphis would be enjoying a most congenial atmosphere, consequently we must resort to other means than mere atmospheric changes to destroy any of these pests. Sulphur is the best remedy with which I am acquainted, and the one upon which gardeners mainly depend. It may be dusted over the plants, or be scattered on the soil beneath them.

When used in the house, the usual method is to place it on the return flue or pipes, being careful not to place the sulphur where it will become so hot as to take fire, for in that case the fumes will destroy the plants as well as spiders. There is but little danger of its taking fire if placed on the return flue, as the heat will usually be just sufficient to slowly melt the sulphur, and cause it to give off its fumes slowly.

Sometimes the sulphur is mixed with soft soap and water, and a little clay added to make the composition of the consistency of thick paint; this is then applied to the pipes and flues, when the sulphur is slowly evaporated and continues giving off its fumes for a long time. The constant fume of sulphur is not needed in a house; besides, it is very disagreeable.

VINE SCALE.

The Vine Scale, *Coccus vites*, is occasionally met, but it is not common. To the unassisted eye it appears to be nothing more than a small scale without the least appearance of life. The scale is the shell or covering of a very minute insect that pierces the bark of the young shoots and sucks its juices. A strong solution of potash—say one pound dissolved in two gallons of water, will quickly destroy them.

It is well to wash the stems of all vines in gardens with potash water every winter, as it would destroy insects that make their nests in the crevices of the bark. That portion of the solution that falls upon the ground is not wasted, because it furnishes the vine with potash, which is one of the most valuable ingredients of all manures.

There are several other species of vine scale or coccus which may be occasionally found. The *Coccus adonidum*, or Mealy Bug, sometimes attacks the vine when grown under glass, but it generally confines itself to other plants. Diluted soft-soap, or potash dissolved in water, will usually destroy all kinds of vine scale.

DISEASES.

The diseases to which the grape is subject in this country are not numerous or very destructive, except in some particular localities, and these are confined mainly to the fruit. The instances are very frequent where whole vineyards are destroyed by allowing them to over-bear; and without doubt more vines are annually destroyed from this cause than from any other. But this should not be called disease, nor the effects of an uncongenial climate, but compulsatory suicide, just as much as it would be to make a prisoner lift at a dead weight until he broke his own back. At least eight tenths of all the failures with our native grapes have been from this cause, and probably one tenth fail from planting unsuitable varieties, and only the other tenth from actual disease.

The case is now becoming quite different, as in the rapidly increasing number of varieties there will, without doubt, be many which are naturally diseased; and when such varieties have been through a course of forced propagation for several years, it would not be strange if we should have some that would baffle the skill of the best cultivators.

When the disease is inherent in the variety, the greatest care will be required to keep the plant even in partial health. Very poor soils or over-rich ones will materially assist in developing the disease; and once overloading the vine will generally make a finish of it. There is not a variety which is sufficiently productive to make it worth cultivating that will not set more fruit than it can bring to maturity, or will not became diseased by overcropping.

The Concord is naturally one of the most healthy of our native varieties, yet I have seen hnndreds of them so overloaded with fruit that not one tenth of it ripened. That vines treated in this manner should remain healthy is not to be expected. Another source of disease lies in planting in heavy wet soils, where the roots are immersed in *stagnant* moisture. It is not always excess of moisture, but the condition of it. Every one who has examined vines in deep valleys, and by the side of streams, have seen some growing where their roots were immersed in water during a greater part of the year, but the water was not confined to one place. It flowed past the roots as it came from springs higher up, or flowed in from the stream perhaps to return again in a few hours.

The too frequent applications of washing-suds from the house is a prolific source of disease in the vines of cities and villages. There are, however, a few diseases which are quite common in some sections of the country, affecting certain varieties, the origin of which it would be difficult to trace, from the fact that the vines had at some time over-borne.

Probably the most destructive disease known to affect the native grape is the black rot. This is the great scourge in the Western States. The vineyards at Cincinnati have been injured more by this than all other causes put together. The Catawba and its seedlings appear to be more affected than other varieties. Still, it is not confined to this

class, as the Isabella and Concord are in some localities more or less affected.

Some ten years since I spent a season in southern Illinois, where this disease is often very destructive. I made a number of experiments for the purpose of ascertaining the cause as well as to find a remedy therefor, but my limited time did not afford me sufficient opportunity to arrive at any satisfactory conclusion; yet I was fully satisfied that a compact wet subsoil was one of the causes, and my observation since has tended to confirm that opinion. The past season this disease showed itself in my garden in Brooklyn for the first time; the location is very high, and the soil is what is usually called a stiff loam, intermingled with stone. Anna, Diana, Isabella, and Catawba were about equally affected, the Concord but slightly. On my place in the country, the soil of which is sandy, there were no signs of this disease.

That an excess of moisture has much to do with this disease is also apparent, from the fact that it is usually more prevalent in wet seasons, or after we have had a long rain. This was the case last season, as about the time the berries were half grown we had several weeks of alternate rain and sunshine, soon after which the disease made its appearance.

In southern Illinois some of the old settlers believed that the rot was caused by the heavy dews, which are usual in that section; this may be one of the causes, but probably there are several that have something to do with it. I have seen vines, a part of which were trained under the eaves of a house; the fruit on this part was not affected, while on that portion which was not so protected from the dew, it was almost entirely destroyed. In the same garden there were vines growing in among the branches of small fruit trees; the grapes on them were sound, while those unprotected were destroyed.

Since that time I have seen several articles in our horti-

cultural papers ascribing heavy dews as the cause of the rot. If this should prove to be the fact, a preventive can be readily applied by nailing a wide board flat-wise on the top of the trellis; it is worth a trial at least. I have never had any difficulty in checking this disease and saving a part of the fruit, the part saved, however, is scarcely worth the trouble.

Dusting the bunches with sulphur at the first appearance of the disease will generally stop its further progress; but this would be a tedious operation to perform on a whole vineyard; besides, the sulphur will adhere to the inside of the bunches until the fruit is ripe, making a rather unpleasant mixture of grapes and sulphur. A preventive is what is wanted, and not a remedy, for of these there have been any number recommended—such as gypsum, ashes, lime, mulching the vineyard, besides the most absurd of all practices, that of allowing the weeds to grow unmolested and the ground without cultivation during the summer. Probably the best method to pursue is to choose those varieties that are the least liable to be affected, and plant them upon well-drained soils.

The first appearance of the disease is a small dark-colored spot upon the green fruit; this soon spreads over the entire berry—the growth is stopped, and it either falls off or shrivels up, still adhering to the bunch. Sometimes the whole cluster is affected; at other times only a few of the berries. This disease (if it is the same) seems to have affected the Concord differently from the other varieties. As the fruit came to its full size, not a berry dropped off with me, but they only changed to a dark red and remained stationary, making no further progress; neither were there any whole bunches affected, only a few berries in each.

MILDEW.

Mildew is a very minute fungus, or parasitic plant, that

attaches itself to living plants and draws its nourishment therefrom; and though generally found upon living bodies, still it attacks only those that are feeble, as these either have not sufficient strength to repel it, or the very weakness of the plant gives it a welcome.

The mildew is usually found upon the leaves of the grape; when it first appears it is but a single small white speck, but it is soon surrounded by others, and by their rapid multiplication they extend over the surface. These minute vesicles are connected by a small thread-like film, which penetrates the epidermis of the leaf, and often goes completely through the leaf; but sometimes it only destroys the epidermis of one side. The mildew, under favorable circumstances, will appear upon different portions of the leaf at the same time, and when this occurs the whole surface is soon overrun—the leaf soon changes its color and its functions are destroyed.

The fungus does not confine itself wholly to the leaf, but often attacks the young green portions of the stem, and lastly the fruit. There are doubtless several species of fungi that feed upon the grape, but the causes that favor the growth of one will probably be congenial to others, and for practical purposes they may all be considered as one. The fruit of our indigenous varieties is not so liable to be infested by mildew as the leaves, but when they are much weakened by it the fruit will seldom entirely escape. The fruit of the foreign varieties, when grown in this country in the open air, will usually be more affected than the leaves, and the same is true with the Southern varieties when grown at the North.

Young vines are more liable to mildew than older ones, and those grown under glass are often very much injured by it. A confined humid atmosphere is very productive of mildew; and though its ravages may often be checked by a liberal application of sulphur and proper ventilation, still, plants that have once become weakened by it are more

liable to it than those that have never been attacked. When the vines are planted too thickly, either in the house or open air, they are more or less liable to be attacked by mildew. Anything that tends to weaken the plants—like a cold soil, sudden changes of weather, or extremes of heat or cold, several cloudy days in succession, followed by bright sunshine, or a few days of cold weather, will usually weaken young plants sufficiently to render them liable to be attacked.

To prevent mildew get good strong plants of healthy varieties, plant them upon a warm soil, and then train them, whether young or old, so that the light and air may reach every leaf. Also, allow no greater number of shoots or leaves to be produced than can be fully developed. A free circulation of air is desirable, but cold northern winds are to be avoided. If these directions are strictly followed, but little injury will result from mildew, even upon those varieties that are generally supposed to be more or less affected.

SUN SCALD.

This is another disease, produced mainly by sudden changes of the atmosphere, although the natural unhealthiness of the plant may have something to do with it. There are but few of our native varieties that suffer much from sun scald, and usually it is those that have soft leaves with a feeble texture. The Isabella is a variety that probably has been more affected by this disease than any other, and it is more prevalent in this vicinity and southward than farther north. It usually makes its appearance after a few cloudy damp days, especially if they are followed by very hot clear weather.

The leaves seem to become blistered or burnt, sometimes the whole leaf will be destroyed, and others will be only affected in spots. That portion injured will turn brown, and in a few days it becomes dry and crisp. If the leaves

on bearing vines are much injured by sun scald the fruit does not mature, and usually it is the largest leaves and those nearest the fruit that are affected the most. The month of August here is very trying upon all varieties that do not possess strong and healthy leaves. The more glossy and shining the surface of the leaves, apparently the less liable are they to sun scald, though there are some varieties with a dull rough surface that I have never known to be affected. Sun scald and mildew often go together, and vines affected by the one are very likely to be attacked by the other.

There is another species of fungus called rust that is sometimes found upon the vines; the young shoots are the part usually attacked. This, however, is not very prevalent, and seldom found upon bearing vines, but confined chiefly to the nursery. It is probably caused by some mismanagement or unsuitable soils.

The foregoing are the principal diseases that prevail to any extent in this country, all of which, with perhaps the single exception of the rot, may be avoided by simply giving the vines a dry soil, and strictly following some judicious method of training. It may be necessary to discard a few of the varieties now in cultivation for particular localities, and this would probably be a gain instead of a loss. And perhaps the rot, which is now so prevalent at the West, may be entirely avoided by the introduction of other varieties.

CHAPTER XIX.

DESCRIPTION OF VARIETIES.

Our nursery catalogues contain an almost endless list of names of grapes, said by their producers to be different varieties, but many of them are so nearly alike it would be difficult for their most intimate acquaintances to point out their differences. The wild vines of our forests, it is true, are not all alike, but they are, with few exceptions, so entirely wanting in all the qualities of a good grape as to be unworthy of notice. The same is true of seedlings. In a collection of a thousand, no two may be just alike while all may be quite similar, and they may be inferior to the parent and unworthy of cultivation.

There are but very few native varieties of the grape that are worth cultivating, and the best of these are comparatively little known.

If a variety succeeds well in one place it is not certain that it will do so in another, although those well acquainted with the requirements of different kinds as to locations, can usually judge very correctly. Neither can any correct estimate of the real value of a variety be made from the appearance of a single vine, because there may be circumstances influencing it that are not known, and it is only when it has been distributed and fruited in different localities that its real value can be ascertained. I might name several varieties that have, during the last ten years, been sent out with high recommendations, that have proved to be entirely worthless. In nearly every case the encomiums were bestowed upon them from noticing the results of a single vine, cultivated with the greatest care. In some instances this vine was original, and in others an old

variety which happened to be placed under circumstances very favorable to its growth and full development. I am thus particular in mentioning these circumstances that the reader may not be misled with high-sounding names or recommendations that may be given to new varieties not thoroughly tested.

We shall have many new kinds offered every season—a few good ones, but more that are worthless; and in most cases we shall be obliged to buy both, that we may test them and judge for ourselves. But it is not advisable to buy largely of any until we have learned their value by actual experiment, or from the personal experience of others upon whose word and judgment we can implicitly rely. In describing a variety of grape we use a number of terms, some of which have a vague meaning to those who do not know the source from which they were derived. For instance, *foxy*, *foxiness*, *foxy flavor*, etc., are terms that are applied to a peculiar flavor or smell which is always found in the wild varieties of the Labrusca species, and it remains to a greater or less degree in all its seedlings. This foxy flavor is, to some persons, not disagreeable, even when it is very intense, as it is in some of the wild varieties; but to others it is extremely offensive. Every country boy and girl in the Eastern States knows what is meant by fox grapes, and they are not likely to forget the peculiar flavor of that fruit when they become older. I well remember when a boy, in Western New York, of knowing where every *frost* grape vine was for miles around; but a *fox* grape would have been a curiosity to me, there being no such thing within the circle of my explorations.

The frost grape belongs to another species, and it has a spicy flavor, but no trace of foxiness; but the frost grape of Western New York is not of the *cordifolia* species, which is the frost grape of Eastern New York, New Jersey, and New England States. The Clinton is a large rep-

resentative of the varieties of the frost grape of Western New York.

These distinctive foxy flavors, particularly when in excess, are not considered a recommendation, but usually detract from the value of a variety. Any variety that has a strong distinctive taste will seldom become a general favorite. A smooth, agreeable flavor, even if it is not rich, will better suit the masses than a rich fruit with a peculiar flavor, for these will suit only peculiar people.

A grape that possesses but very little sugar and very little acid may be agreeable, but not rich; for a fruit to be of the *best* quality must contain sugar and acids in abundance, along with the other ingredients that are found in all good grapes. A small quantity of sugar and lemon-juice does not make a good glass of lemonade—plenty of both being required. We have many varieties of grapes that are good, and those who have never eaten anything better will be satisfied with such until they have tasted those that are superior. A grape may be really rich in quality, and still possess a flavor that to a majority of persons would be intolerable. There has been and there is still much discussion as to what constitutes best quality in a grape, and so long as we allow some particular characteristic to be our guide instead of the whole, we shall never settle the question. One person admires a large grape, while another cares nothing about size, but wants a sweet grape; these are only matters of taste and do not affect quality; for quality in a grape is essentially a compound, but taste is simple.

The following are some of the requisites of a grape of the first quality:

1st. A large amount of sugar.

2d. A large amount of acids, principally tartaric.

3d. A brittle, tender pulp; if it is nearly a liquid, so much the better.

4th. No strong, distinctive flavor.

5th. Large and moderately compact bunch.
6th. Large berry.
7th. Small seeds.
8th. Berries adhering firmly to their peduncles.
9th. Thin skin, but sufficiently tough to prevent bursting.

The above characteristics refer more particularly to table grapes, as wine grapes may possess particular characters and flavors that would very much detract from their value as dessert fruit, and still be unsurpassed for wine.

The most popular grapes for the dessert are seldom the best for wine, as the peculiar taste or odor that is offensive in the fruit may be changed by fermentation so as to become agreeable in wine.

The form and corresponding size of our native varieties may be seen by reference to the following figures. Fig. 85 is what is usually termed small; Fig. 86, medium; Fig. 87, large; Fig. 88, very large; these are all round: Fig. 89, oval; Fig. 90, oblong oval: this latter form is as yet quite rare. I have only met one variety that has oblong oval berries.

Fig. 85.

Fig. 86.

Fig. 87.

Fig. 88.

Fig. 89.

Fig. 90.

ADIRONDAC.

What is supposed to be the original vine of the Adirondac grape was found in the grounds of J. G. Witherbee, at Port Henry, in the town of Moriah, Essex County, New York, and first noticed in 1852. The vine stands about ten rods up the slope, and about fifty feet above the waters of Lake Champlain. The hills at the base of which the vine grows are some two hundred feet high, and shelter it on all sides as well as it could be protected naturally, the valley opening only to the south. The situation is very favorable in every respect for the early maturing and full development of the fruit, with the one exception of being rather too far north for many of our best varieties.

I visited this vine in the fall of 1862 and took notes of the surroundings, and description of fruit, etc.; on my return I made a verbal report to the Fruit Growers' weekly meeting at the office of the *American Agriculturist*. That report, as published, is on the whole correct, with the exception of the last line, which reads: "*I consider it a great acquisition;*" it ought to have read, "*If* this variety proves to be as good in other locations as there, I shall consider it a great acquisition." When I first saw the report in print, I did not notice that I had been made to recommend a new variety from merely seeing one vine in fruit; and I am far from having any such confidence in my own abilities as to determine the future value of a grape by seeing only one vine in bearing.

The fruit from the original vine of the Adirondac has been shown the past season, and still promises well, but how it will prove in other localities is still unknown. It is without doubt a seedling of the Isabella, and may possess some of the faults of that variety when removed farther South.

The following description was made at the time of visit-

ing the original vine: bunch large and compact, shouldered. Berries large, round. Skin thin, dark, nearly black, covered with a delicate bloom. Flesh tender, with scarcely any pulp, melting sweet, but not rich. The leaves large, resemble the Isabella, but apparently thicker, and the upper surface more uneven. Also the alæ of the large leaves overlap considerably. Ripens before the Isabella, but how much earlier I can not judge from appearances. A strong and vigorous grower.

ANNA.

Raised by Eli Hasbrouck, of Newburg, New York. Seedling of Catawba. Bunches large, loose, and shouldered. Berries large, white, covered with a thin white bloom. Flesh very tough at the center; so much so that it is hardly worthy of cultivation at the North; the pulp may become more tender when grown in more southern localities, where the season will allow it to become fully ripe. The small amount of juice between the tough pulp and skin is very sprightly, rich, and excellent. A good strong grower, and productive. Ripens in this vicinity the first to middle of October.

ALLEN'S HYBRID.

There were originally several varieties of grapes disseminated under the above name, they being kept distinct by the use of numbers; at present but one is known under the name of Allen's Hybrid. This is supposed to be a hybrid of the *Vitis Labrusca* species and the *Vitis Vinifera*, and has more of the characteristics of the two species combined than any other of the so-called hybrids. It was raised by J. F. Allen, Salem, Massachusetts. Bunches medium to large, shouldered, sometimes clustered, compact. Berries medium, round. Skin thin, pale amber, when fully ripe.

Flesh tender, without pulp, sprightly and vinous, excellent. Early, ripens the first of September. Vine not very hardy, but sufficiently so for garden culture in most of the Northern States. It will not do for vineyard culture unless the vines are covered in winter and the situation is well protected, as its leaves sometimes suffer from the strong cool northern winds in summer.

ALVEY, OR HAGAR.

The Alvey belongs to a class of Southern grapes that have not, upon a whole, been very successful at the North, as most of them have proved too tender for vineyard culture; besides, the season is usually too short to allow them to fully mature the fruit. The Alvey appears to be quite hardy in protected situations, and fully ripens; but the berries, like all of its class, are too small for a table grape—they would do for wine.

Bunches medium to large, loose, shouldered. Berries small, round. Skin thin, black, covered with a very thin blue bloom. Flesh without pulp, vinous. Ripens the middle to last of September. A strong grower. Leaves roundish, obscurely three-lobed, coarsely toothed. Deep green above and beneath, the upper surface shining.

CONCORD.

This variety was raised by E. W. Bull, of Concord, Massachusetts. It is a really fine native grape, and has steadily grown in favor ever since its introduction, and probably there are more vines of it being planted at the present time than of any other variety. It is very hardy, of vigorous growth, and very productive. Its beautiful appearance makes it one of the most attractive market grapes; and for this purpose there is perhaps no variety that excels it.

Among all the varieties that have been thoroughly tested, the Concord is without doubt the most profitable for market. It will grow and produce abundant crops in situations and upon soils where some of the better flavored and more delicate varieties would utterly fail. Although its fruit can not be called the best in quality, still it seems to suit the masses; or at least they prefer an abundance, if it is not quite so delicate, to a small supply of something that is really superb.

Geo. Husmann, the well known vineyardist of Hermann, Missouri, says that the Concord has proved to be an excellent wine grape in that locality; and I have no reason to doubt his testimony, though it is doubtful if it will prove to be a good wine grape here.

Bunch compact, large, shouldered. Berries large, round, black, thickly covered with a beautiful blue bloom. Skin thin, often very thin. Flesh moderately juicy, sweet, rather buttery. Pulp quite tender when fully ripe; sometimes quite acid at the center, with considerable of the foxy flavor. Vine very hardy and vigorous. Leaves very thick and enduring; dark green above, rusty beneath. Ripens from 10th to 20th of September.

CLINTON.

The Clinton is supposed to have been first introduced to public notice some thirty years ago, by a Mr. Langworthy, of Rochester, New York. The vine is so very hardy and vigorous that it often succeeds in localities where all others fail. It is at the present time being recommended more particularly for wine, and without doubt in many localities proves to be valuable for that purpose. The fruit possesses a peculiar spicy flavor that is very agreeable to many persons. When thoroughly ripe it is far better than many of the new varieties. It should be planted on rather poor soil, as it is naturally a rampant grower,

and when planted in rich soils it is almost uncontrollable. Bunches medium, usually shouldered, but often irreg- Bunches medium, usually shouldered, but often not irregular in size, compact. Berries medium, round, black, covered with pale blue bloom; juicy, spicy, vinous flavor. Leaves green above and smooth beneath. Ripens 15th to 25th of September.

CASSADY.

An accidental seedling found in the garden of P. H. Cassady, of Philadelphia. It has not proved to be more than third-rate with me, but it is said to be quite good in some localities at the West. Bunches medium, compact, rarely shouldered. Berry medium, round, greenish-white, sometimes pale amber on one side; covered with a whitish bloom. Flesh juicy with considerable pulp, vinous but not rich. Leaves large, pale green above and whitish woolly beneath. A strong and vigorous grower, but with me it has been quite unproductive. Ripens the last of September.

CREVELING—Catawissa, or Bloom.

A new variety from Pennsylvania, said to be very early. Not fully tested except in the vicinity where it originated. Bunches medium, compact, shouldered. Berries medium to large, nearly round, black, with but little bloom. Flesh moderately juicy, sweet, not high flavored, but good. Vine hardy and vigorous. Judging from the few vines that have borne fruit in this vicinity the past season, it is no earlier than several others of the new varieties.

CATAWBA.

This old and well-known variety was introduced to notice some forty years ago by John Adlum, of Georgetown, District of Columbia. It has been for many years the

standard vine grape of the country, but owing to its uncertainty on account of the rot, it is now in many sections being discarded, and other and more reliable kinds being planted instead. It was never a favorite in the Eastern States, owing to its lateness in ripening. In localities where it will fully mature, and is not affected with rot, there are very few better varieties. Bunches medium to large, rather loose, shouldered. Berries large, round. Skin thick, deep red, covered with a lilac bloom. Flesh pulpy, sweet, with a rich, vinous, and somewhat musky flavor. Vine vigorous and productive.

CUYAHOGA.

This is supposed to be an accidental seedling, found and introduced to notice by a Mr. Wemple, of Collamer, Cuyahoga County, Ohio. It has been considerably distributed in the last five or six years, but its real character has not been fully ascertained; a large portion of the vines appear to be more or less subject to mildew, and the fruit is rather late in ripening. Some four years since I received a variety from Cincinnati, under the name of Coleman's White, which has proved to be the same as Cuyahoga. Whether there is a distinct variety called Coleman's, or that it is only another name for Cuyahoga, I have not been able to ascertain. Bunches medium, shouldered, compact, Berries medium to large, round, covered with a very thin bloom. Pulp tender, juicy, and sweet, but little flavor, not rich. Color, pale greenish white. Wood short jointed, and the vine a strong and vigorous grower when not attacked by mildew. Ripens first of October.

DELAWARE.

This grape is supposed to have originated in the garden of Paul H. Provost, in Kingswood Township, Hunterdon

County, New Jersey. It is a purely native variety, and probably a seedling of Catawba, or one of that group. It was first brought to notice by H. Thompson, of Delaware County, Ohio. If I could have but one variety for my own use, it certainly would be the Delaware, as it is the highest flavored native grape known. It is rather a slender grower at first, but when it becomes old and well established, it is what may be called a good grower, but never a rampant one. All that it requires is a good rich soil, with fair culture, to produce the best results. Bunch medium, very compact, and generally shouldered. Berries medium, round. Skin thin, of a beautiful dark-red color when fully ripe. Flesh tender and juicy, scarcely any pulp, exceedingly sweet, but still brisk and vinous, never cloying to the taste. Vine very hardy, moderately vigorous, and productive. Ripens the first of September.

DIANA.

A seedling of Catawba, raised by Mrs. Diana Crehore, of Boston, and introduced to public notice about twenty-five years ago. There is probably no one variety of grape in cultivation in regard to which there is a greater diversity of opinion, and its variableness fully warrants all that is said about it. In one section it is really excellent, while in another, perhaps near by, it is entirely worthless; and the same difference is often observable in the same garden, and from no apparent cause. It is one of the best keeping grapes that we have, owing, in a great measure, to its thick skin.

Bunches medium to large, compact, not generally shouldered. Berries medium, sometimes quite large, round, often ripen very unevenly. Skin thick, pale red, covered with a thin bloom. Flesh tender, with some pulp, juicy, rich, sweet, and vinous; but in some seasons and localities it possesses a peculiar musky flavor that is to

most persons very offensive. After the fruit has been gathered for some time, this peculiar flavor in a great measure disappears. Vine is vigorous and productive, quite hardy here, but will require covering in most places at the North. Ripens middle to last of September.

ELSINBURGH.

Supposed to have originated in Elsingburgh, Salem County, New Jersey. This little grape has been in cultivation for many years, but owing to its small size it has never been highly valued. Bunches medium to large, rather loose, shouldered. Berries small, skin thin, black, covered with a thin blue bloom. Flesh without pulp, sweet, vinous flavor. Leaves dark-green, smooth. Wood long, jointed, and slender. Ripens the last of September.

GOLDEN CLINTON, OR KING.

This grape is supposed to be a seedling of the Clinton, and resembles that variety very much, with the exception of its fruit, which is greenish white, with a yellow tinge instead of black. The size and quality of the fruit is about the same as the Clinton. It can scarcely be called an improvement on the original, unless its color be considered one.

HARTFORD PROLIFIC.

This grape has been before the public for several years, but did not seem to be fully appreciated until quite lately; it is now being planted principally for market, as it is the earliest of the passably good grapes of the color that we have among the well-tried varieties. It is wonderfully productive and hardy, and unless the vine is severely

pruned, and the young bearing canes checked in summer, the bunches will be loose and the fruit will shake off quite easily. Raised by Mr. Steel, of Hartford, Connecticut. Bunches large, shouldered, compact. Berries large, round. Skin rather thick, black, with very little bloom. Flesh sweet, juicy, with considerable pulp; somewhat foxy in flavor. Ripens the first week in September.

HERBEMONT.

This variety has been disseminated under several different names—such as Warren, Neal Grape, Herbemonts, Madeira, etc. Its origin is unknown, but was introduced here from South Carolina some thirty years ago. It is not suited to the Northern States, as the vine is quite tender and the fruit often mildews; besides, it is quite late in ripening. In gardens or well-protected situations it will sometimes succeed, as will almost any of the tender varieties. It is said to do very well in the southern part of Ohio, and farther south, but it is of no value here except when protected as we have indicated. Bunches very large, shouldered, exceedingly compact. Berries small, round, dark blue-black, covered with a light bloom. Skin thin, without pulp, juicy, sweet, and vinous. Vine a very coarse grower. Wood light-colored, covered with a white waxy bloom. Ripens first of November.

IONA.

A new variety, raised by C. W. Grant, of Iona Island, near Peekskill, New York. It has as yet been but very little disseminated, but from the few vines that have borne in different localities, we can judge something of its character. I have had it in bearing for the past three years, and consider it the most promising of all the new varieties. It is a seedling of the Catawba, and the leaf

somewhat resembles that variety, but more clear and of a brighter green. The vine is a strong and vigorous grower, short jointed, and quite hardy. Bunches large, shouldered, compact. Berries large, round, semi-transparent when they begin to ripen, but growing opaque as the color deepens. Skin thin, pale red, with small deep red veins at first, changing to dark red when fully ripe. Flesh tender, with very little pulp at the center. Sweet brisk flavor, excellent, but not quite equal to Delaware. Ripens from 10th to 20th of September.

ISRAELLA.

This is another seedling raised by Dr. Grant, and one that promises well, although I am not aware of its having been fruited, except at Iona, where it originated. I have several times eaten fruit from the original vine at the Island, and have been very much pleased with it. How it will succeed in other localities is yet to be ascertained. Should this and the Adirondac sustain their present character, we shall have two really good varieties added to our now rather small list. Bunches medium to large, shouldered, compact. Berries large, slightly oval. Skin thin, black. Flesh tender to the center, sweet, and rich. Ripens the first of September.

ISABELLA.

This is too well known to need a description. There was a time when it had no competitor in the New York market; and even now there are comparatively few of any other kind to be seen until the Catawbas come in from the West. The newer varieties are being brought forward in large quantities each year, and they will probably sooner or later take the place of the Isabella; not because it is so much inferior to some of the new kinds, but because it

is so uncertain in this vicinity. It is really more uncertain here than farther north. The leaves seem to fail just at the time they are needed to aid in ripening the fruit. The month of August is usually very trying to the leaves of all kinds, and unless they are naturally strong and healthy they are sure to suffer in this vicinity, though they may entirely escape in another.

LE NOIR—The Black.

This is another of a quite large class of Southern varieties that have been introduced into the Northern States during the last twenty or thirty years, none of which have proved to be of any great value here, as they are usually rather tender. For garden culture some of them are quite desirable, as they are different in character from our Northern varieties. They often reach us under different names; and there is at present so much confusion in regard to the correct names for the different varieties, that I shall not attempt to fully describe any of them. The one known as Le Noir is quite distinct from Herbemont, both in growth and foliage. The wood is shorter jointed and much darker in color, the leaves nearer round. The fruit gives color at least two weeks earlier; bunches not so compact and much better.. The Louisville Seedling appears to be the same as Le Noir. The Lincoln resembles the Le Noir, with leaves more distinctly lobed. Pauline is similar to Herbemont, but fruit lighter color; and to those I may add Long, Devereux, Harris, Thurmond, Wylie, St. Genevieve, Ohio Cigar Box, and a half dozen more that I have received as distinct and valuable varieties. If they are different I have not been able to detect it. The Alvey, Lincoln, and Le Noir are probably the best for the Northern States; and even these are not so good when cultivated here as are many indigenous to this section. This class of grapes may be properly called wine grapes, and in sections

where they fully ripen they are hardly to be surpassed for making light delicate wine.

LOGAN.

This grape was, on its introduction, supposed to be a great acquisition, and sold rapidly at an enormous price; but it has sadly failed to meet public expectation, being of only second quality. Bunches medium, shouldered, compact. Berries medium to large, oval. Flesh juicy, with little pulp, usually rather insipid in flavor. Vine a slender grower, leaves small, three-lobed. Ripens middle of September.

LYDIA.

A new variety, raised by Mr. Carpenter, of Kelly's Island, in Lake Erie. It is a large white grape that promises well.

MARTHA.

Raised by Samuel Miller, Calmdale, Lebanon County, Pennsylvania. Not yet disseminated. The entire stock of this, and another seedling not yet named, is in the hands of J. Knox, of Pittsburg, Pennsylvania. I am indebted to Geo. Husmann for the following description, which he made while visiting Mr. Miller's place last fall: bunches medium, rather loose, shouldered. Berries large, round, pale yellow. Slightly pulpy, sweet, juicy, very slightly foxy. Quality very good, most of the berries containing only a single seed, and that very small. Vine a strong grower, hardy and healthy, promises to be very productive. A seedling of Concord.

NORTON'S VIRGINIA.

Raised by Dr. Norton, of Richmond, Virginia, about forty years ago. It seldom ripens so as to be eatable in

this vicinity, and is too harsh and sour to make wine. Farther south, and in some parts of the West, it is said to become sweet, at least sufficiently so to make an excellent wine. It is quite hardy, and remarkably free from disease. The vineyardists of Hermann, Missouri, esteem it as one of the best and most reliable wine grapes they have. Bunches very long, occasionally shouldered, not very compact. Berries small, round. Skin thin, black. Flesh a little pulpy, rather harsh in flavor. A strong healthy grower. Leaves pale bright green. Ripens here middle to last of October.

REBECCA.

An accidental seedling, found in the garden of E. M. Peake, of Hudson, New York. It is probably a seedling of Isabella, as it resembles, in its general character, many of the white varieties grown from that kind. They are usually rather insipid in flavor, and the leaves are more or less liable to mildew. The Rebecca is rather tender—too much so to be of value for vineyard culture. It succeeds very well in protected situations, and it requires a dry soil, as the roots appear to be more sensitive than the top. Bunches medium, compact, not generally shouldered. Berries medium to large, slightly oval, skin thin, pale green, tinged with yellow, with a light bloom. Flesh tender, with very little pulp; sweet, but not rich. Ripens 15th to 25th of September.

ROGERS' HYBRIDS.

Raised by Mr. Rogers, of Salem, Mass., and claimed to be hybrids, between a variety of *Vitis Labrusca* and *Vitis vinifera;* but judging from what I have seen of them, they are but pure native varieties of the Labrusca species. If this should prove to be the case it would not detract from their merits, but give us more confidence in

them than if they were a mixture of the two species named.

It is to be regretted that these varieties were not thoroughly tested, names given to the best of them, and the others discarded, before any were sent out, as there has already been considerable confusion created in endeavoring to keep them distinct by the use of numbers only. They are but little known except in the vicinity where they originated. Nos. 4, 15, and 19 are at present believed to be the best.

The following description is that given by Mr. Rogers, and though it may be correct as they appeared to him at the time of writing it, still it is not to be supposed that they will all prove to be equally as good in other localities.

"No. 1.—This is a splendid-looking grape; bunch large, shouldered; berries large, very oval, resembling the Malaga in shape; color, amber, flushed with red on one side; skin very thin; flesh tender, juicy with high aromatic flavor; ripens with Isabella.

"No. 2.—Bunch large, shouldered; berries large, inclined to oval; color purple or black; flesh tender, of a very high aromatic vinous flavor; ripens with Isabella.

"No. 3.—This is one of the earliest of the collection; bunch of good size; berry round; color red, like Diana; skin thin; flesh very tender and juicy, with a slight taste of the Native in flavor; as early as the Hartford Prolific.

"No. 4.—This is a splendid-looking fruit, much resembling a Black Hamburgh; berries large, slightly oval; skin thin, with thick bloom; flesh tender, sweet, and melting; as early or earlier than the Concord.

"No. 5.—Bunch medium; berry large, roundish in form; color, dark red; flesh tender, very sweet, with a rich aromatic flavor; one of the earliest.

"No. 9.—This is a variety which received a premium at the Ohio State Fair, as the second best seedling, in 1861. It has a bunch of medium size; berry medium, round;

color like Diana; flesh tender, sweet, high aromatic flavor; earlier than Diana.

"No. 15.—This is considered the best grape of the collection, by the majority of good judges; bunch of good size, rather loose, shouldered; berries roundish, large; color, amber, darker than the Catawba; tender, with no tough pulp, juicy, and of very rich aromatic flavor, and superior, in the opinion of good judges, to any of the best new varieties of hardy grapes grown here; early; fully ripe this season ten days before the Concord, growing within a few feet; vine very vigorous and free from mildew, where Isabella and Rebecca growing near were very much affected.

"No. 19.—This is a variety for which a premium was given as the best hybrid grape at the exhibition of the Essex Agricultural Society, 1859, and of which the committee spoke as follows: 'This large, early grape, of the size and color of the Black Hamburgh, we thought to be the finest variety shown; bunches and fruit large and compact, and a strong grower. We can not but consider this sort to be an acquisition for this locality, where the Isabella and Diana are apt to fail.'

"No. 22.—Color, amber; bunch and berry of good size; flesh of a rich aromatic flavor.

"No. 30.—Bunch large, shouldered; berries large, roundish; color, light amber; flesh tender and juicy, of a rich aromatic flavor; ripens with Diana; vine vigorous and very productive.

"No. 33.—Bunch large, shouldered, and compact; berry large; color black; flesh tender, sugary, and of a rich, high flavor; one of the earliest—by some pronounced the best.

"No. 43.—Bunch large, and shouldered; berry medium, roundish; color, black; flesh tender, of a sweet, pleasant flavor; very productive and early.

"No. 44.—Much like the last, a little earlier; bunch

large, looser; berry medium; color, black; flesh very sweet and tender."

TAYLOR'S BULLITT.

Introduced to notice by Judge Taylor, of Jericho, Henry County, Kentucky. It is one of those rampant growers that we often meet among the wild varieties. It may answer to cover arbors where shade is valued, but is questionable if it is really worth cultivating for its fruit. It is very unproductive, and the bunches are usually so small and deformed that it requires a very large vine to produce even a small number of pounds. Some of our Western vineyardists say that it is productive; if so, it is there of a different character than here, for with me it is worthless. I have seen it in bearing in several places, and have examined the fruit sent from the West, but as yet I have not been so fortunate as to see even a medium-sized bunch. The fruit is of medium-size, pale greenish white, and not of bad quality; but there is altogether too little of it. The stamens of the flowers are generally deformed, not affording pollen sufficient to fertilize the stigma; consequently the fruit fails.

UNION VILLAGE

Originated among the Shakers at Union Village, Ohio. It resembles the Isabella, and is probably a seedling of that variety, and scarcely better in quality though of nearly double the size. It is undoubtedly the largest native grape that we have. Bunches very large, compact, shouldered; berries very large, round when fully ripe, quite sweet, not rich, with very little pulp; skin thin, black, covered with bloom. Vine a vigorous and coarse grower. Ripens first to middle of October.

ADDITIONAL LIST.

The following list comprises those varieties of which we know but little, as they have not been thoroughly tested, and another class which we have either fully tested or have seen enough to know that they are not worthy of cultivation at the present time, although before the introduction of better varieties they were the best to be had. In giving this list, and making notes upon the different varieties, I do not wish to be understood as deciding for others; I give my own opinion, and if it disagrees with that of others I can not help it.

I have remarked that the real value of a variety can not always be determined by the appearance or quality of the fruit upon a single vine. A variety may, however, possess a character so poor that there would be no hope of improving it so as to make it worthy of place even in the largest collection. For instance, no one will suppose that a wild fox grape can be changed by cultivation so that it would be really any better than when it was in its wild state. Wild fruits are seldom much improved by cultivation. It is only when we produce new varieties from seed that we can expect improvements, and it is only the highly improved varieties that are much affected by slight changes of soil and location. Keeping this in mind, we can the more readily determine the value of any new variety that may be presented to us. No amount of care or change of soil or location will make a wild fox or frost grape worthy of cultivation; and any seedling that partakes strongly of the wild character of the species from which they were grown, will not be likely to be much improved.

ALEXANDER.

Bunch large, shouldered, compact. Berries medium to large, oval, black. Poor flavor, somewhat foxy. Too late to be of value here.

ARKANSAS.

About a dozen different varieties are disseminated under this name, probably not one of them of any value. A large black variety, sold under this name, has proved to be the Isabella.

ALBINO, OR ALBINESS.

A large white grape, tough, sour, and worthless.

ALLAIR.

A large red grape of no value.

BAXTER.

One of the Southern group. Late. Very acid. Of no value here.

BLUE FAVORITE.

Similar to the last, and frequently worthless.

CHIPPEWA, CYNTHIANA, AND MISSOURI.

These three varieties are of very similar character. Fruit small, black, or blue-black. Sour and worthless.

CANBY'S AUGUST—see YORK MADEIRA.

CLOANTHA.

Resembles the Isabella in appearance, but quite foxy.

COWAN.

A variety considerably grown on the shores of Lake Champlain and river St. Lawrence. Medium size, black, handsome, but very harsh and sour. A new seedling from this, called the Sherman, is said to be an improvement.

EMILY.

Two varieties have been sent out under this name. One

is a small, black, worthless wild grape, and the other is a red grape, which is either a foreign variety or seedling of one, and of no more value than the former.

EARLY HUDSON.

Of medium size, round, black. Quite early. Not very good, but curious, inasmuch as many of the berries contain no seeds.

FANCHER.

Through the kindness of Mr. Charles Downing, I have received several specimens of the fruit from the original vine; and judging from these, it is neither more nor less than the Catawba. It may be a seedling of the Catawba; if so, it is probably only another case of reproduction without any considerable variation.

FRANKLIN.

A small black grape that may prove very good for wine, but is not good enough for a table grape. Vine very vigorous, hardy, and productive.

GARRIGUES.

The difference between this and the Isabella is so slight, if any, that it ought not to be called a distinct variety. Two vines of the Isabella growing in the same garden will often show a greater difference than has ever been claimed to be between the Garrigues and Isabella.

GRAVEL GRAPE.

Appropriately named. Small, black, worthless.

GRAHAM.

A small, dark-colored grape; requires a warm, protected situation to insure its ripening. Sweet, sprightly, and good. Will probably be valuable farther south.

HYDE'S ELIZA.

Raised by Mr. Wilkes Hyde, near Catskill, New York. It has been in cultivation some forty years, but has not been considered of any great value. Vine hardy and productive. Berries medium, black, covered with a blue bloom. Sweet, with little pulp, but of fair quality. Ripens the last of August to 10th of September. Vine hardy and productive.

LOUISA.

Raised by Samuel Miller, Calmdale, Pennsylvania. It is very similar to Isabella, but appears to be earlier, and the vine not so subject to disease.

MANHATTAN.

Originated on Long Island. Bunches small. Berries medium, round, greenish white, covered with bloom. Sweet, with tough pulp. Strong foxy flavor. Berries fall from the bunch with very little handling. Scarcely worth cultivating. Vine and leaves covered with a whitish waxy bloom.

MAXATAWNEY.

Originated at Eagleville, Berks County, Pennsylvania. Bunches medium to large, moderately compact. Berries medium, greenish white, oval. Flesh quite tender, without pulp when fully ripe. Quality good. It is rather too late in this locality to be reliable.

MARION.

Some half dozen varieties in cultivation under this name. The large black Marion is the Isabella. Another is a red fox grape. The Marion Port is one of the varieties of the frost grape—small, black, sour, and worthless.

MARY ANN.

An early black grape, with large bunches. Berries oblong oval, quite sweet, but very foxy.

MEADE'S SEEDLING.

Supposed to be an accidental seedling; found in the garden of John Meade, Lowell, Massachusetts, in 1847. Said to be a seedling of the Catawba; if so, it is so near like its parent that I have not been able to detect the difference.

MILES.

Bunches medium. Berries medium, black, oblong. Sweet, rather buttery, but good. Very early. Vine a strong and vigorous grower.

NORTH AMERICA.

A large black fox grape, quite early. Sweet, but with so much of the foxy character that it is not worthy of being called good.

NEBRASKA.

I have received several vines from Nebraska, under different names, but so far they appear to be all of the same variety, possessing no particular value to the vineyardist. They are, however, in a botanical sense, quite interesting.

ONTARIO.

This was supposed to be a new and distinct variety, but I believe it is generally admitted by our best judges to be the Union Village.

OPORTO.

Although this variety has been christened with a foreign name, probably because it was thought it would make a wine similar to port, still it is a true native, of the same species as the Taylor's Bullitt, and possessing the same defect in its flowers. The bunches are usually very imperfect. Berries small, black, harsh, and very acid. It is, take it altogether, the poorest, with one exception, of all the varieties that it has been my lot to purchase. It is

said to be a good and productive variety in some localities; if so, then change in location can work a more wondrous change in quality than we have ever given it credit for.

PERKINS.

One of the varieties received under this name has proved to be the Isabella; and the other is a small black fox grape of no value.

RULAND, OR RULANDER.

There may be a distinct variety by this name, but the one I have received is the Logan. In visiting Mr. Downing the past season, I found that he had received the same variety under the same name as myself.

ST. CATHERINE.

Those who admire the foxy flavor of some of our native grapes will find much in this variety to admire. The bunches and berries are very large and handsome, and the berries adhere to the bunch quite firmly for one of its class. They are quite sweet, with considerable toughness in the pulp, and a strong foxy flavor. Vine hardy, vigorous, and productive.

TO KALON.

A very large and really beautiful grape. The color is dark mahogany, approaching a black when fully ripe. The fruit is so uncertain, being subject to rot, that in this vicinity it is hardly worth planting. An occasional vine will succeed very well, and in other localities it may prove to be more certain.

UNDERHILL'S SEEDLING.

Raised by Dr. A. K. Underhill, Charlton, Saratoga County, New York. Exhibited at the great grape show at the *American Agriculturist* office, 41 Park Row, New York, Oct., 1863. From notes made at the time I take

the following: bunches medium. Berries large, round. Flesh sweet, with tough pulp at the center; not so foxy in flavor as some others, yet too much so to be pleasant. Skin thick, dark red, similar in color to Catawba. Berries shake off from the bunch very easily. Of no more value than many other fox grapes.

WILMINGTON.

In appearance this is one of the most beautiful of the new white varieties, but in quality it is not more than third-rate; it may be better farther south, or in very warm, protected situations. Bunches very large, loose, shouldered. Berries large, round, quite acid, with a pungent flavor. Skin thick, greenish white, covered with bloom, A vigorous, coarse grower, with large tough leaves; wood long jointed. Ripens middle to last of October.

YORK MADEIRA.

An old variety, sometimes called Canby's August. It is small, black, early, but harsh in flavor; so much so, that it is little esteemed at the present time.

The following are a few of the new varieties that have not been fully tested. Some of them have not yet been sent out by their originators. Probably a few of the number will prove to be valuable acquisitions: Archer, Brackett's Seedling, Emma, Elizabeth, Coriell, Mary, Haskel, Mottled (Carpenter's), Urbana.

There are probably one hundred different varieties of the wild fox grapes that are offered and highly recommended in some nursery catalogues. Some of them are merely the wild varieties, just as they were found in their native localities; others may be a little larger either in bunch or berry than those usually found. The Dracut Amber and Blood's Black are slightly improved varieties, while such as Blood's White, Camden, Provost White, Sage, Massa-

chusetts White, and hosts of others, are just such grapes as are found in almost all the woods of the Eastern States.

There is a greater or less number of varieties belonging to each of the native species of the grape, therefore it can readily be seen what an easy matter it would be to make up a long list of names of varieties, without, perhaps, having a single kind among the whole that would be worth cultivating, and still they might all be more or less distinct.

Foreign varieties are often given a new name and sent out as new native grapes. They are mostly of the Sweet Water or Chasselas varieties, as these usually succeed better than those of the Hamburgh and Muscat; but they are on the whole entirely unsuited to our climate, although in a few isolated locations they will sometimes succeed very well for a time. Another method of increasing varieties, which is almost as disreputable as the last, is that of raising seedlings from foreign varieties and passing them off as native. These are really nothing more than foreign varieties, and growing them from seed does not make them native grapes. Among this latter class we have the Brinkle, Merritt's Seedling, Canadian Chief, Childs' Superb, El Paso, and a number of others which I forbear to mention, as enough have been enumerated to give the reader an idea of the caution and fortitude which he will need in establishing a vineyard of even the most moderate extent.

CHAPTER XX.

REVIEW OF VARIOUS SYSTEMS OF PRUNING AND TRAINING.

In giving a synopsis of some of the most prominent modes of training the vine, I shall not attempt to describe them at length, or go into the minute details that have been connected with carrying out any particular system, but only aim to show the general principle involved. That error will often accompany truth, and creep in among the most simple plans, as well as among those that are intricate, is quite certain; and when at last the error is discovered, we wonder that it could have remained so long hidden under so slight a covering.

False theories and false ideas have been, and probably will ever be, entertained and promulgated in regard to grape culture. I lay no claim to infallibility, and while I shall attempt to point out some of the errors of others, I do not deny the right of all to criticise my modes of culture and training, but rather invite it, believing that in this way, sooner than in any other, the true system will be established.

In glancing over the various systems of training that have been in use for the last two thousand years, we observe that all of those which have continued in use for any length of time, appear to have been founded upon what we at the present time call the renewal system—that is, the young canes are cut back every year, and from buds on these are produced, not only fruiting canes, but other buds from which fruiting canes will again be produced; and thus two things are kept in view, fruit this year, and fruit buds for the next, and both in close proximity. By this

method the vine produces an annual crop, never resting longer than nature designed it should; for nature seems to have appointed a period of rest and for labor for all the members of both the animal and vegetable kingdoms. But with this known fact, so apparent to the observing mind, there seem to have been those who were so anxious to assist nature, that they overstepped her laws and endeavored to give her a longer period of rest at one time, and more work at another than she required; and in this way the *alternate* renewal system of training the vine was invented. Although this system of training may be, in some of its various modifications, quite successful for a time, the principle upon which the whole structure rests is an erroneous one, and will eventually end in failure.

The first one of these systems that I shall mention is the one advocated by Mr. Wm. Bright, of Philadelphia, in his treatise on the grape in 1860. His system, which he calls the "Single-stem Dwarf-renewal System," goes beyond all the others, and grasps the very foundation, for its object is the renewal of the whole vine or stem, instead of a part, as in others.

The main points of this system are as follows: the vines are planted in rows, say six or eight feet apart, and placed two feet apart in the row. Each vine is allowed to produce but one cane, and so soon as this is strong enough to produce fruit, then the training proper commences. Suppose that we have a row of vines, each with one cane, as seen at Fig. 91; now we will cut the first one down to one bud, and the next at three feet, and so on, every alternate vine being cut back to one bud (or at least but one is to be allowed to grow), and the others to the length at which we wish them to fruit. Those vines that

Fig. 91.

have been pruned to three feet are expected to produce fruit, and the others to produce canes for fruiting next year. Fig. 92 shows a vine pruned for fruiting, and to prevent the sap flowing too rapidly to the upper buds, the cane is allowed to remain lying on the ground, or is placed in a horizontal position until the buds start, then it is tied to a trellis or stake in an upright position. A portion of the buds on the cane are allowed to push out and produce fruit, and the others rubbed off. Fig. 93 shows a vine with

Fig. 92.

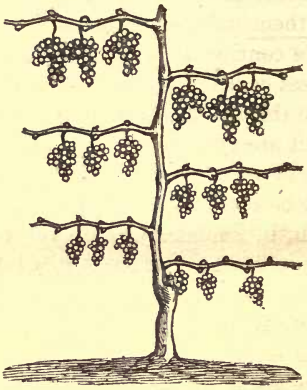

Fig. 93.

three bearing spurs on each side. The bearing shoots are to be stopped a few leaves beyond the last bunch of fruit, the same as in other modes.

The sap will pass with greater force into the upper branches than into the lower, consequently the fruit upon them will be much larger and better developed than upon those below; the difference will usually be about as shown in the vine, Fig. 93. The next pruning of these bearing vines will be the same as with the one cane before fruiting—that is, down to one bud. And here we meet the main difficulty in this system, for there are no well-developed buds on the cane, as they have grown out the season pre-

vious and formed canes; consequently, if the cane is cut back, and all these side branches removed, we must depend upon some accessory bud to produce another cane; a good one is seldom furnished in this way, and there is no certainty of producing one at all. To be sure the cane may be cut off just above the lower spur, and a bud on this be allowed to grow and produce a cane in place of the one removed. But here we meet still another difficulty—that is, the buds on the lower fruit spur or branch are never so well developed as on the upper ones, and the cane produced from them will usually be only of moderate strength; and we are continually endeavoring to produce what should be the best canes from the weakest buds.

The third season the young vines that were not allowed to fruit are now brought into the same shape as the others, and they produce side branches and fruit, after which they are to be cut down. At the end of the third season, after the vines commence fruiting, the system winds up, or so nearly so that no uniform mode of pruning can be followed; nor will there be any regularity in the growth or appearance of the vines.

This seems to have been the fate of all the strictly alternate renewal systems that have ever been invented. Mr. Bright discovered his mistake when he commenced pruning his bearing vines. And although he had committed himself to the system, and urged it with much force, still, so soon as he found that it was likely to fail, he promptly came forward and confessed himself mistaken, thereby showing that he possessed the rare qualification of making a vigorous attack and beating a gentlemanly retreat.

The next alternate renewal system that claims attention is one with horizontal arms and upright canes. In this system of training, we commence with the one cane the first season and two the next, and the third season these two canes are laid down for arms; these should be about four feet long, and only four buds upon each allowed to

grow and produce canes. The vine is now supposed to be three years old, and the alternate pruning commences at this time, and for convenience sake we will call this the first year of pruning; every alternate upright cane is cut back to one bud, and the others are cut off to four feet. Fig. 94 shows a vine with the four upright canes at full

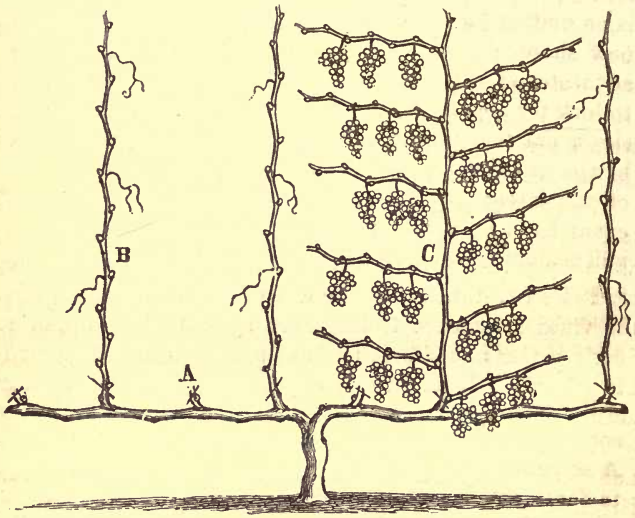

Fig. 94.

length, B, and the others cut back to the one bud, A. The four canes are supposed to produce side spurs or fruiting canes their entire length, as the one shown, C; this they can be made to do, but the upper portion of the stem will produce the best fruit in every case. At the end of the second year we will have four new canes from the four canes that were cut down to one bud, provided they have grown, which they will sometimes fail to do, because the sap will usually flow past these single buds and into the canes where there is a greater number of buds to attract it. But for argument's sake we will admit that there is no

trouble upon this score, and the few single buds have each produced a strong cane suitable for fruiting; we proceed to cut back those that have fruited down to the arms—the small cross line near the base of each shows where they are to be cut. They are all supposed to have borne fruit, like the one at c; and here we meet the same difficulty that we did with Bright's single-stem system; that is, there is no bud at the base of the bearing canes to produce a new shoot; but according to the rule laid down by the advocates of this system, we will cut them back and trust to luck for another cane. The other four canes will now throw out their side branches and produce fruit; and this brings us to the end of the third season: and unless some of the latent buds at the base of the previous season's canes have produced good strong new ones, which they will seldom do, our alternate renewal is run out. Various expedients will have to be resorted to in order to carry the vine successfully through even to the end of the third year after the first pruning of the upright canes. In the first place, the buds at the base of the four-feet bearing canes will not push unless the canes are bent in some manner so as to check the flow of sap. A serpentine form is the one usually adopted to force out the lower buds. Fig. 95 shows an upright cane bent in what is called the serpentine form, in order to check the flow of sap and force out the bud on its entire length. And again, these upright canes will set more fruit than they can mature, and a portion of it, or of the buds themselves, when they first start, must be removed. But the great difficulty is that the vine is thrown out of balance, and the sap is drawn into the canes where there is the greatest number of buds. Where one cane has ten buds and the other but one, it is easy to see which will have the ad-

Fig. 95.

vantage; not that with the single bud, as those who are unacquainted with the vine might suppose, but the one having ten. These difficulties are sometimes avoided in different ways The upright canes are bent to force out the lower buds, and then instead of cutting down the bearing canes to their base, they are cut above one of the side spurs as before stated, and a shoot produced from this; but all of these changes produce confusion and irregularity. I doubt if there has ever existed, or ever will, a vine pruned on the alternate renewal system as advocated by at least a dozen writers that I could name, that was not a failure before it had been pruned four times for fruiting. It may have young shoots and still bear fruit, but anything like regularity in the arrangement is at an end.

There are various other systems of training in which the alternate renewal is the main feature, or is a part; but it must be apparent to every one who has ever studied or practiced vine growing, that the less alternate renewal

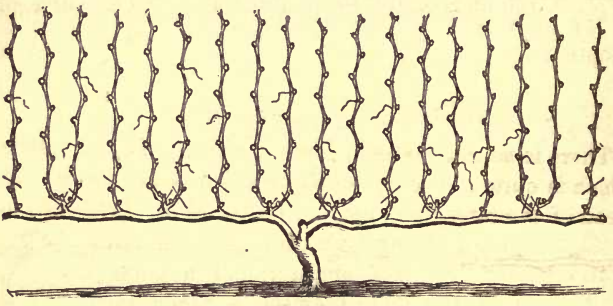

Fig. 96.

there is in any system the better. It seems to be very difficult to eradicate the idea that one portion of the vine requires a partial rest, while another part is perhaps performing more than its due proportion of work, and thereby throwing its forces out of balance.

Fig. 96 shows a vine trained with horizontal arms, but

with alternate single and double fruiting canes; this is almost the alternate renewal, though at the first glance it would be taken to be a strictly renewal system. The cross lines near the base of the upright canes will show where they are to be pruned to keep up this plan. On the double spur one of the canes is to be cut entirely away, and the other to one bud, and the single cane is cut off at two buds, and where there are now two canes, next year there will be but one; and the single cane of this season will produce two canes the next, thus alternating each year. This plan seems to be a very plausible one; but when we come to try it, we find that the spurs with two buds are inclined to grow more rapidly than those with only one, for the simple reason that the sap is drawn to that point with two-fold greater power than to the single bud. If all were pruned to one bud, then the sap would be drawn to all alike; and the same would be the case if all were pruned to any other number, from one upward. A hint upon such points as these will, I think, be sufficient, for it is a very easy matter to try pruning a few vines upon both plans before fully adopting either.

REVERSING THE ARMS.

There is an old German plan of laying down the arms, which is quite the reverse of those we have shown. Instead of the right-hand cane being laid down to the right,

Fig. 97.

it is bent over to the left, and the left one is bent to the right, as shown in Fig 97, the object being to check the flow of sap, and cause the buds to break more evenly than

if the canes were laid down without reversing them. It does have this effect upon the canes, and there is no particular objection to it, although the same effect is produced when the arms are curved down in the manner shown in a preceding chapter. Some of those who advocate this mode of forming the arms, claim that the check that is given the vine by thus bending them is a benefit, and that its good effects continue after the first year; this, however, is very doubtful, because the growth of the vine is made up of concentric layers of wood, one of which is formed every year, and the layer of wood which is formed over the one-year cane after it is bent down, would have its internal structure conformed to this position, and the juices would flow just as freely through the new wood at the bend as it would elsewhere.

SINGLE ARM SYSTEM.

We have here a system that we are told is the very best that has ever been invented. It comes across the water fully indorsed, and it also has its advocates in this country; but with all this testimony in its favor I believe it to have one radical defect, and that it will not prove satisfactory unless that is remedied. Fig. 98 shows a vine trained upon this comparatively new plan, and I think that any one who has followed me through the foregoing pages, or has himself trained vines, will see in a moment where the defect lies; but for fear that he should not, I will point it out. The vines are planted only three or four feet apart, and are grown and pruned in the same manner as when we train with two arms, until the time of forming the arms, then only one cane is laid down and the other is cut to three buds. When the buds push, four to six are selected upon the arms for upright canes, and the others rubbed off. The three buds left upon the other cane are allowed to grow, and if the vine is a strong one, all the buds will produce fruit, as shown in the engraving.

The bearing canes on the arm are to be stopped at the usual height, while those on the main spur, and directly over the stock, are allowed to grow above those on the

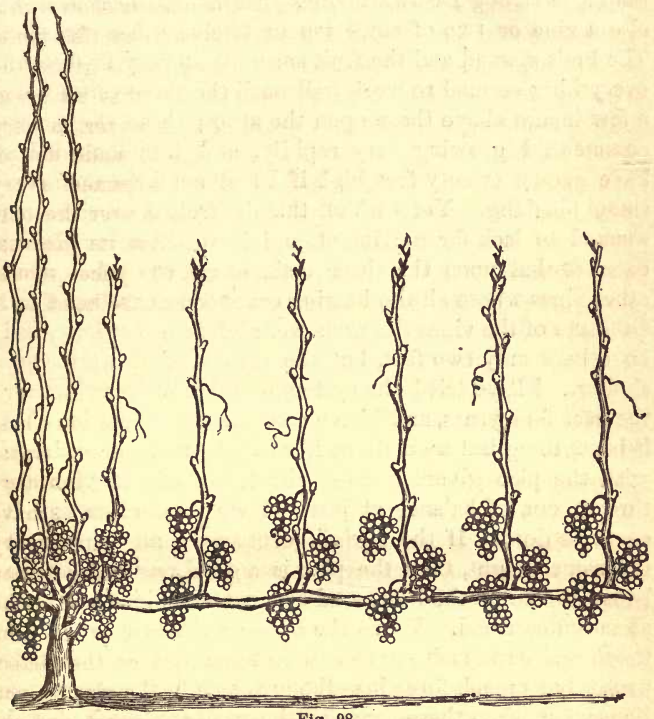

Fig. 98.

arm, and remain unchecked until later in the season. Now it is plain that after these three canes have got above the others, the sap will flow into them more rapidly than into the others; besides, the arm being bent, the flow of sap into it is partially checked, while it can flow directly upward without obstruction into the longest canes; and this diversion of the course of the sap takes place just at the time the fruit on the arms need it the most.

Having seen this plan highly recommended in some European works on grape culture, I was persuaded to try it upon several varieties; and for this purpose I selected ten large strong Delaware vines that had two canes each, also a vine or two of some ten or twelve other varieties. The buds started and the fruit set upon all very finely, and everything seemed to work well until the three canes were a few inches above those upon the arms; these three then commenced growing very rapidly, and would probably have grown twenty feet high if I had not kept up a continual pinching. Yet with all this the fruit upon the arms seemed to lack for nutriment, and it was far from being equal to that upon the three main canes, or to that upon other vines where all the bearing canes were checked alike. On some of the vines the arms were left four feet long, and on others only two feet, but the results of all were very similar. I have tried the system on more or less vines for the past four years, and I have come to the conclusion that it is anything but a good one if carried out in accordance with the plan given, because the forces of the vine are thrown out of balance at just the worst possible time it could be done. If the upright canes were all stopped at the same height, then the plan is a good one, but it then becomes simply the horizontal arm system which has been already described. When the buds on the arm first start they require so much sap to sustain them, that it flows with probably as much force into the arm as into the other portions; but when these canes on the arm are checked and the others allowed to run, the equilibrium is destroyed.

In a German work called the "Winzerbuch" (wine book), by F. Rubens, and published at Leipzig, in 1858, we find a similar system shown at page 144, but with results much like those I have mentioned; for the canes on the arm are shown as small and weak, or about one fourth the size of those that have grown from the main stem. This plan has also been described by several French writers, and

has been fully indorsed by Dr. Grant; but these recommendations or indorsements do not affect the system, for the vines will persist in being governed by natural laws in spite of them.

BOW SYSTEM.

The Bow system of training has been and is still practiced to some extent in the vineyards in Ohio and other parts of the country. When this form is adopted, the vines are usually trained upon stakes and planted nearer together than when trained with arms.

Fig. 99.

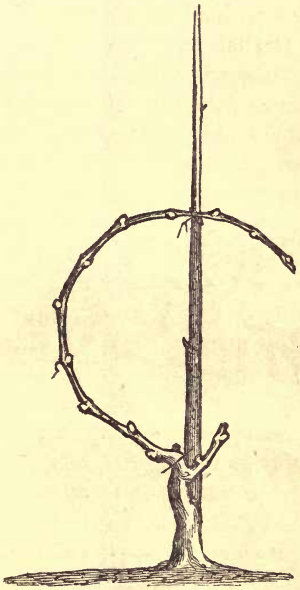

Fig. 100.

The vines are started the same as with other systems until we have obtained two strong canes; then one is cut down to two or three buds, and the other to eight or twelve, according to the strength of the vine. Fig. 99

shows the new canes as pruned. The longest cane is then bent and forms what is called the bow. Sometimes the end is brought around and tied to the stake, and at others it is only bent in a half circle and tied where it crosses the stake, as shown in Fig. 100. Two stakes are sometimes used, so as to better support the bow when it is covered with fruit and foliage. The fruit is mainly produced on the bow, and the young bearing shoots are stopped two or three leaves beyond the last bunch of fruit. The two buds left on the spur are allowed to grow and form canes, one of which is taken for the bow next season. The cane which forms the bow is cut away after it has borne one season. The cross line at its base shows where it is to be cut. Fig. 101 shows the vine as it appears with fruit. The same plan is pursued every year; one of the two canes is cut at a sufficient length to form the bow, and the other cut back to two or three buds. When the vine becomes old and strong, two bows are formed instead of one. The objections to this system are, that when trained on stakes the bearing shoots have no support, and they swing

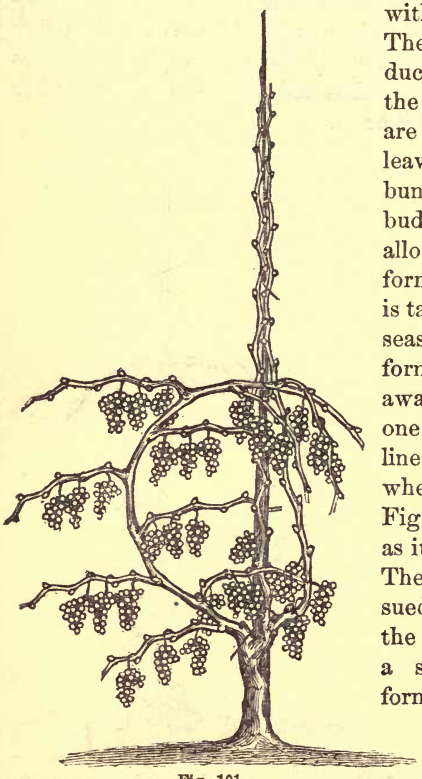

Fig. 101.

about, and the fruit is more or less damaged by rubbing against the leaves and vine; when trellises are substituted for stakes this difficulty is removed. Still the same objection remains which exists in the single arm system—that is, one portion of the vine is severely checked while another is allowed to grow freely. The circulation of the sap in the bow becomes less rapid as the upright canes advance, and the fruit upon it is only partially supplied with nutriment at the time when it is most needed. Where wine is the object, the bow system may answer very well, as the fruit is probably hastened in maturity by the severe check that is given to the flow of sap.

Fig. 102 shows a bow system as given by Rubens. It

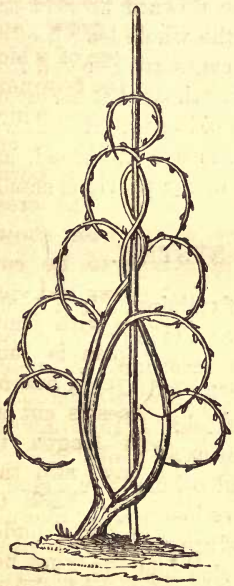

Fig. 102.

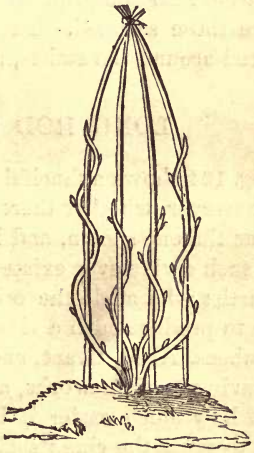

Fig. 103.

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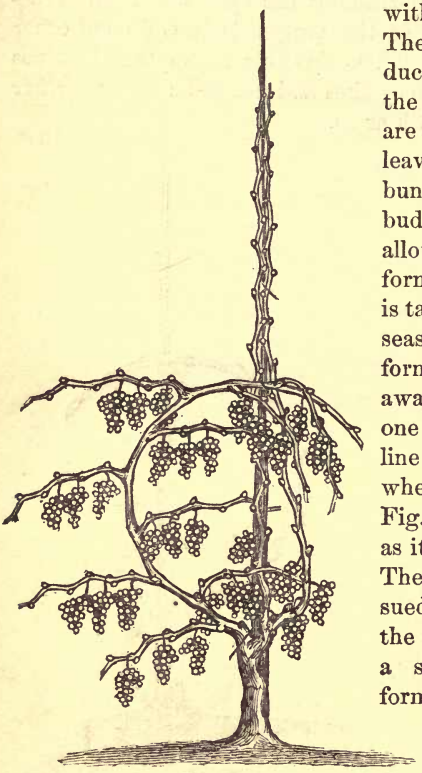

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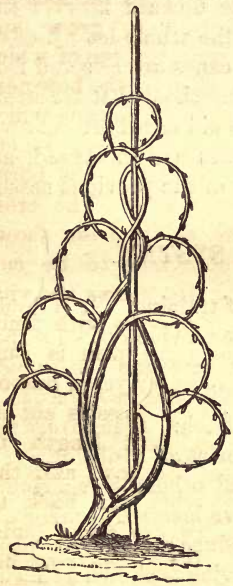

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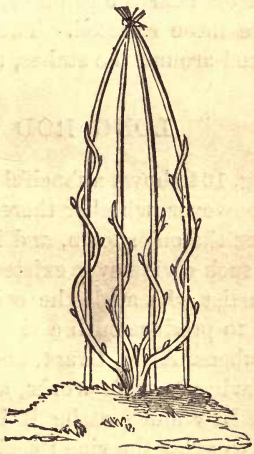

Fig. 103.

is merely a multiplication of bows upon the same vine. Three or four canes are grown, two of which are left at

considerable length, and by twisting them about the stake, shoots are produced which are bent down and form the bows. It is merely a fancy system, and shows what can be done with the vine; but it is really of no practical use.

Fig. 103 shows a system of serpentine training taken from Rubens' work, and also given by Dr. Grant. This plan is a very good one for garden culture, as the vines are trained to stakes and pruned low. The stakes are set eight inches to a foot apart, and the upper ends brought together and fastened as shown. The vines are first grown with one cane; the next season two, and the next with four; but instead of cutting them down to the two buds, they are cut off at from two to four feet, and the cane twisted around the stakes; this checks the upward flow of sap, and causes all the buds to push on the whole length of the cane. The next season four more canes are selected from among the new ones (always choosing those that are strong and from near the ground), and the old canes are cut away above those selected. The new ones are shortened, and twisted around the stakes, as those of the previous season.

LONG ROD SPUR SYSTEM.

Fig. 104 shows a fanciful mode of training. It is doubtful, however, whether there was ever a vine grown so perfect as the one shown, and it is not reasonable to suppose that such a vine ever existed except in the imagination of the artist who made the original sketch. It is barely possible to produce such a vine, but not at all probable.

Rubens, Allen, Grant, and several others give a similar engraving in their works, and I have inserted it merely to show how much easier it is to produce a vine upon paper than to grow the vine itself. This vine is shown as having twenty spurs upon it, each of which is pruned the same as though they were on a horizontal arm. The vine is supposed to be produced by regular steps through a succes-

sion of years; but any one who has ever seen a vine growing, must know that the upward tendency of the sap would prevent the lower buds retaining their vitality upon a vine of this height.

UPRIGHT CANES
WITH SIDE SPURS.

I have adopted this name for the want of a better, and applied it to a system that has been described in most of our late works on pomology under the name of renewal system, which is not very definite, as the renewal part is applied to so many others.

Fig. 105 shows the general form of training adopted in this plan. The vines are started the same as for the alternate renewal system, but the upright canes on the arms are all allowed to remain at equal length, say from four to six feet. The vines are trained on a trellis with horizontal wires, which should be placed about a foot apart, so that the young side-shoots can be conveniently tied together. But two upright canes are here shown on each arm; the

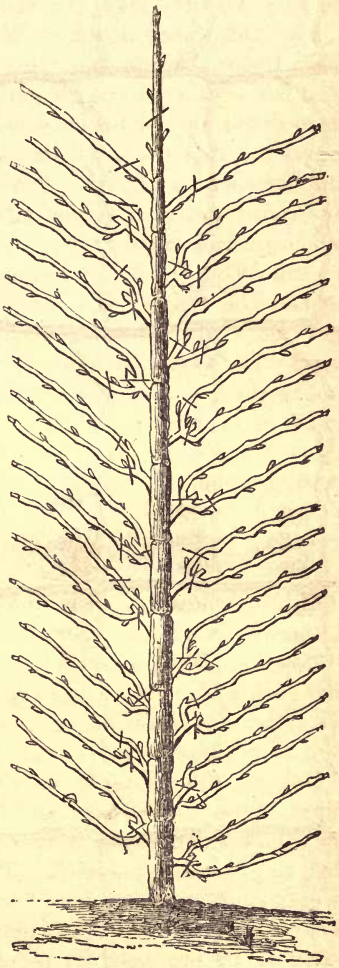

Fig. 104.

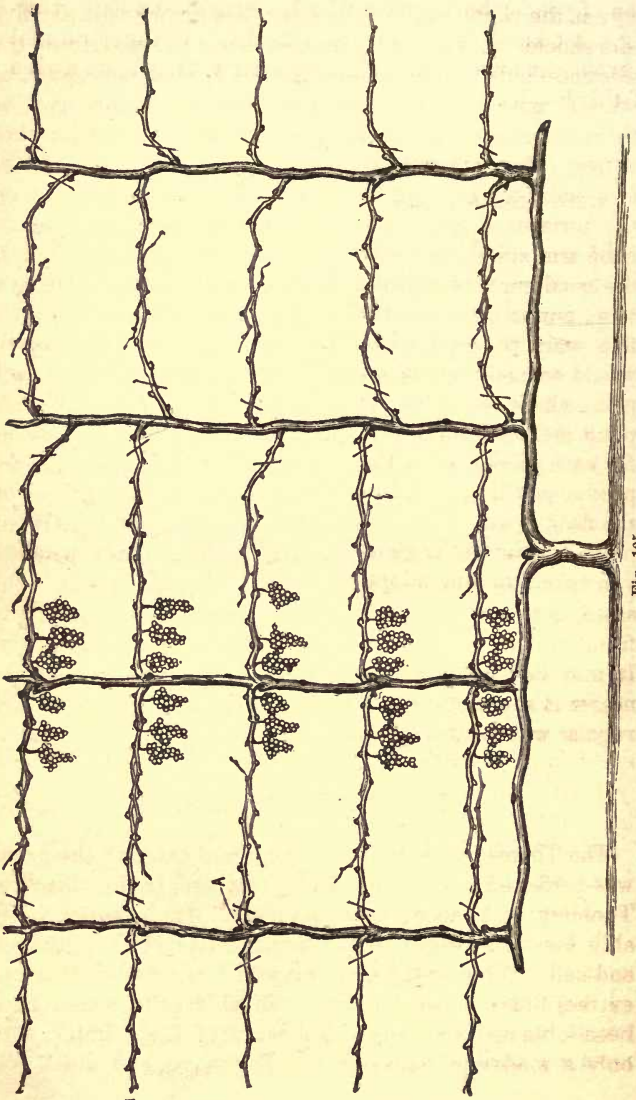

Fig. 105.

two at the right hand of the figure are shown with the five side-shoots on each side, as they are produced from the alternate buds on the cane. These side-shoots or spurs, as we will now call them, are supposed to produce two or three bunches each, making from twenty to thirty bunches apiece. Every year these are cut back to within one or two buds of the uprights, in a similar manner to those on the horizontal arm. The two upright canes on the left-hand arm are shown with spurs exactly opposite, which is the usual manner of showing them in illustrating the system; but to produce them in this manner, it would require five years to perfect the five pairs of spurs; because it would be necessary to stop the vine while growing at each point where the spurs are wanted, or prune it back to that point and then make the terminal bud produce two shoots for each pair of spurs; and by the time the upper pair are produced, the lower ones will have failed, in consequence of the flow of sap to the top of the vine; and just here is the point where all such systems fail. No matter whether you take one year or ten to perfect them, the result is the same, as no cane of four to six feet long will bear regularly from one end to the other when trained perpendicularly. It may be distorted in any manner you choose, but the nearer it approaches the horizontal the more uniform and regular will be the results.

THOMERY SYSTEM.

The Thomery system of growing and training the grape was perfected about a hundred years ago, at the village of Thomery, in France; hence its name. Its invention probably owes its origin to the peculiarities of the situation and soil at Thomery, which compelled its founders to adopt extraordinary means to bring about results which have been obtained in many other parts of the country with only a moderate outlay in the beginning, and much less

time than it takes to perfect this somewhat intricate and tedious system.

Between thirty and forty years ago the Thomery was brought prominently before the American public by some of our leading pomologists—such as Lowell, Kenrick, and others; but the long time that it takes to perfect it seems to have discouraged its adoption. In America, land is too cheap, and the impatience of the people too great, for this system in all its details to become popular for at least a hundred years to come. It is not only a system of training the vine, but of layering and general arrangement of the vineyard, to be carried on from the very commencement by regular steps through a succession of years (usually from eight to twelve) to completion.

The horizontal arm and spur-pruning, such as I have given on previous pages, is often called the Thomery system, and though it is a part of it, still it does not comprise the whole, any more than one of the planets comprises the whole of the solar system.

In the past three or four years this system has again been brought prominently before the public by several writers on grape culture, and it is to be hoped that some of its advocates will have the patience and skill to carry it out and perfect a half acre or more of vines on this plan, so that it may be demonstrated whether it is an economical method to adopt with our native varieties. That the vines will be improved in growth by the plan of layering, which is one of the features of the system, is quite certain; but that it is at all necessary with strong growing varieties is very doubtful.

The system does not seem to be fully understood by all who have attempted to describe it; at least they do not agree, for some have shown the vines with alternate double and single bearing canes, as seen on page 246, Fig. 96; and others with them all double. Rubens, in his work, shows the vines all equally balanced and with two canes growing

from each spur, and we find it shown the same in many other European works on grape culture. In the excellent work of Dr. Ecorchard, Professor of Botany and Director of the Garden of Plants at Nantes, the Thomery system is most fully illustrated, and its whole *rationale* explained in a clear and explicit manner; but there are no alternate single and double canes given. Now whether these men are all wrong and the others are right, I leave it with the reader to judge.

CATALOGUE

OF

WORKS ON GRAPE CULTURE

PUBLISHED IN THE UNITED STATES, WITH DATE AND PLACE OF PUBLICATION, AND NAMES OF AUTHORS.

1823.—A Memoir on the Cultivation of the Vine. By John Adlum, Washington, D. C.

1826.—The American Vinedresser's Guide. John James Dufour ; Cincinnati, Ohio.

1829.—The American Vinedresser's Guide. Alphonse Loubat, N. Y.

1829.—Vinedresser's Theoretical and Practical Manual. Théabaut de Berneaud (translated from the French), New York.

1830.—American Manual of the Grape Vine. C. S. Rafinesque, Phila.

1830.—Treatise on the Vine. William R. Prince, New York.

1834.—Observations on the European Vine. S. I. Fisher, Philadelphia.

1837.—Practical Treatise on the Cultivation of the Grape Vine. Clement Hoare (reprint from the English edition), Boston.

1846.—Cultivation of American Grape Vines. Alden Spooner, Brooklyn, N. Y.

1848.—Grapes and Wine. James Busby, New York.

1852.—Culture of the Grape. Robert Buchanan ; Cincinnati, Ohio.

1852.—American Grape Grower's Guide. Wm. Chorlton, New York.

1853.—The Cold Grapery. William Chorlton, New York.

1853.—A Practical Treatise on the Culture of the Grape Vine. J. Fiske Allen, New York.

1854.—A Rough Sketch of the Renewal System of Pruning Grape Vines. William Martin, Sr., Pittsburg, Pa.

1855.—The Vine; its Culture in the United States. R. H. Phelps, Hartford, Conn.

1856.—A Treatise on the Culture and Management of Grape Vines. James Suydam, Brooklyn, N. Y.

1856.—New Process of the Culture of the Vine. Persoz (translated by J. O'C. Barclay), New York.

1859.—Vinedresser's Manual. Charles Reemelin, New York.

1859.—Grape Culture. H. De Caradeuc, Augusta, Georgia.

1860.—Both Sides of the Grape Question. William Saunders, Phila.

1860.—Bright on the Grape. William Bright, Philadelphia.

1862.—Open Air Grape Culture. John Phin, New York.

1863.—Our Hardy Grapes. J. M. Knowlton, New York.

1863.—An Essay on the Culture of the Grape. George Husmann, Hermann, Mo.

1863.—Grape Culture and Wine Making. A. Haraszthy, New York.

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